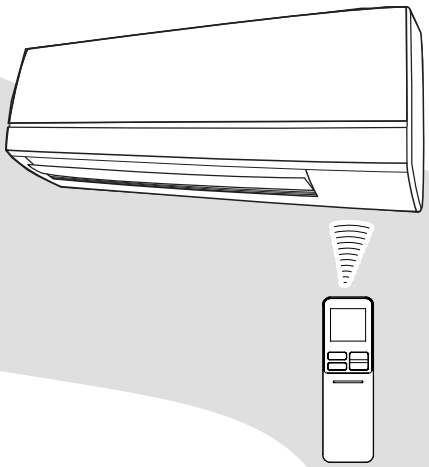
TOSHIBA
Carrier

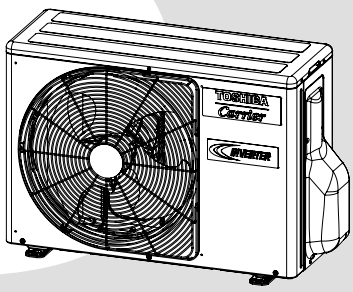
FILE NO. SVM-13069-4

SERVICE MANUAL

AIR-CONDITIONER
SPLIT TYPE

Indoor Unit <High Wall, Heat Pump Type>	Outdoor Unit <Heat Pump Type>
RAS-09EKV-UL	***RAS-09EAV-UL***
RAS-12EKV-UL	***RAS-12EAV-UL***
RAS-09EKV-UL	***RAS-09EAV2-UL***
RAS-12EKV-UL	***RAS-12EAV2-UL***





HFC
R410A

Revised on Jun, 2014

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1. SAFETY PRECAUTIONS

Installing, staring up, and servicing air-conditioning equipment can be hazardous due to system pressures, electrical components, and equipment location (roofs, elevated structures, etc.).

Only trained, qualified installers and service mechanics should install, start-up, and service this equipment.

Untrained personnel can perform basic maintenance functions such as cleaning coils. All other operations should be performed by trained service personnel.

When working on the equipment, observe precautions in the literature and on tags, stickers, and labels attached to the equipment.

Follow all safety codes, Wear safety glasses and work gloves. Keep quenching cloth and fire extinguisher near by when brazing. Use care in handling, rigging, and setting bulky equipment.

Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and National Electrical Code (NEC) for special requirements. Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury. Understand these signal words : DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol.

DANGER identifies the most serious hazards which will result in severs personal injury or death. WARNING signifies hazards which could result in personal injury or death. CAUTION is used to identify unsafe practices which may result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which will result in enhanced installation, reliability, or operation.

- Before installation, please read these precautions for safety carefully.
- Be sure to follow the precautions provided here to avoid safety risks. The symbols and their meanings are shown below.

WARNING : It indicates that incorrect use of this unit may cause severe injury or death.
CAUTION : FAILURE TO FOLLOW THIS CAUTION may result in equipment damage or improper operation and personal injury.

CAUTION

New refrigerant air conditioner installation

- **THIS AIR CONDITIONER USES THE NEW HFC REFRIGERANT (R410A), WHICH DOES NOT DESTROY THE OZONE LAYER.**
  R410A refrigerant is affected by inpurities such as water and oils because the pressure of R410A refrigerant is approx. 1.6 times of refrigerant R22.
  ALSO NEW OILS ARE USED WITH R410A, THUS ALWAYS USE NEW REFRIGERANT PIPING AND DO NOT ALLOW MOISTURE OR DUST TO ENTER THE SYSTEM.
  To avoid mixing refrigerant and refrigerant machine oil, the sizes of charging port on the main unit is different than those used on R22 machines and different tools will be required.
- **EQUIPMENT DAMAGE HAZARD**
  Failure to follow this caution may result in equipment damage or improper operation.
  Do not bury more than 36 in. (914 mm) of refrigerant pipe in the ground. If any section of pipe is buried, there must be a 6 in. (152 mm) vertical rise to the valve connections on the outdoor units. If more than the recommended length is buried, refrigerant may migrate to the cooter buried section during extended periods of system shutdown. This causes refrigerant slugging and could possibly damage the compressor at start-up.

DANGER

- FOR USE BY QUALIFIED PERSONS ONLY.
- TURN OFF MAIN POWER SUPPLY BEFORE.ATTEMPTING ANY ELECTRICAL WORK. MAKE SURE ALL POWER SWITCHES ARE OFF. FAILURE TO DO SO MAY CAUSE ELECTRIC SHOCK.
- CONNECT THE CONNECTING CABLE CORRECTLY. IF THE CONNECTING CABLE IS CONNECTED WRONGLY, ELECTRIC PARTS MAY BE DAMAGED.
- CHECK THE EARTH WIRE THAT IT IS NOT BROKEN OR DISCONNECTED BEFORE INSTALLATION.
- DO NOT INSTALL NEAR CONCENTRATIONS OF COMBUSTIBLE GAS OR GAS VAPORS. FAILURE TO FOLLOW THIS INSTRUCTION CAN RESULT IN FIRE OR EXPLOSION.
- TO PREVENT OVERHEATION THE INDOOR UNIT AND CAUSING A FIRE HAZARD, PLACE THE UNIT WELL AWAY (MORE THAN 2 M) FROM HEAT SOURCES SUCH AS RADIATORS, HEATERS, FURNACE, STOVES, ETC.
- WHEN MOVING THE AIR CONDITIONER FOR INSTALLING IT IN ANOTHER PLACE AGAIN, BE VERY CAREFUL NOT TO GET THE SPECIFIED REFRIGERANT (R410A) WITH ANY OTHER GASEOUS BODY INTO THE REFRIGERATION CYCLE. IF AIR OR ANY OTHER GAS IS MIXED IN THE REFRIGERANT, THE GAS PRESSURE IN THE REFRIGERATION CYCLE BECOMES ABNORMALLY HIGH AND IT RESULTINGLY CAUSES BURST OF THE PIPE AND INJURIES ON PERSONS.
- IN THE EVENT THAT THE REFRIGERANT LEAK, DURING INSTALLATION WORK, IMMEDIATELY ALLOW FRESH AIR INTO THE ROOM. IF THE REFRIGERANT GAS IS HEATED BY FIRE OR SOMETHING ELSE, IT CAUSE GENERATION OF POISONOUS GAS.

WARNING

- **ELECTRICAL SHOCK HAZARD**
  Failure to follow this warning could result in personal injury or death.
  Before installing, modifying, or servicing system, main electrical disconnect switch must be in the OFF position. There may be more than 1 disconnect switch. Lock out and tag switch with a suitable warning label.
- Never modify this unit by removing any of the safety guards or bypassing any of the safety interlock switches.
- Installation work must be purformed by qualified personnel only.
- Specified tools and pipe parts for model R410A are required, and installation work must be done in accordance with the manual. HFC type refrigerant R410A has 1.6 times more pressure than that of conventional refrigerant (R22). Use the specified pipe parts, and ensure correct installation, otherwise damage and/or injury may be caused. At the same time, water leakage, electrical shock, and fire may occur.
- Be sure to install the unit in a place which can sufficiently bear its weight. If the load bearing of the unit is not enough, or installation of the unit is improper, the unit may fall and result in injury.
- Electrical work must be performed by trained, qualified installers and service mechanics in accordance with the code governing such installation work, internal wiring regulations, and the manual. A dedicated circuit and the rated voltage must be used. Insufficient power supply or improper installation may cause electrical shock or fire.
- Use a cabtyre cable to connect wires in the indoor/outdoor units. Midway connection is not allowed. Improper connection or fixing may cause a fire.
- Wiring between the indoor unit and outdoor units must be well shaped so that the cover can be firmly placed. Improper cover installation may cause increased heat, fire, or electrical shock at the terminal area.
- Be sure to use only approved accessories or the specified parts. Failure to do so may cause the unit to fall, water leakage, fire or electrical shock.
- After the installation work. ensure that there is no leakage of refrigerant gas. If the refrigerant gas leaks out of the pipe into the room and is heated by fire or something else from a fanheater, stove or gas range, it causes generation of poisonous gas.
- Make sure the equipment is properly grounded. Do not connect the ground wire to a gas pipe, water pipe, lightning conductor, or telephone earth wire. Improper earth work may be the cause of electrical shock.
- Do not install the unit where flammable gas may leak. If there is any gas leakage or accumulation around the unit, it can cause a fire.
- Do not select a location for installation where there may be excessive water or humidity, such as a bathroom. Deterioration of insulation nay cause electrical shock or fire.
- Installation work must be performed following the instructions in this installation manual. Improper installation may cause water leakage, electrical shock or fire. Check the following items before operating the unit.
  - Be sure that the pipe connection is well placed and there are no leaks.
  - Check that the service valve is open. If the service valve is closed, it may cause overpressure and result in compressor damage. At the same time, if there is a leak in the connection part, it may cause air suction and overpressure, resulting in damage to the unit or injury.
- In a pump-down operation, be sure to stop the compressor unit before removing the refrigerant pipe. If removing the refrigerant pipe while the compressor is operating with the service valve opened, it may cause air suction and overpressure, resulting in damage to the unit or injury.
- Do not modity the power cable, connect the cable midway, or use a multiple outlet extension cable. Doing so may cause contact failure, insulation failure, or excess current, resulting in fire or electrical shock.
- If you detect any damage, do not install the unit. Contact your dealer immediately.

CAUTION

- Exposure of unit to water or other moisture before installation could result in electric shock. Do not store it in a wet basement or expose to rain or water.
- After unpacking the unit, examine it carefully for possible damage. Report any damages to your distributor.
- Do not install in a place that can increase the vibration of the unit. Do not install in a place that can amplify the noise level of the unit or where noise and discharged air might disturb neighbors.
- Please read this installation manual carefully before installing the unit. It contains further important instructions for proper installation.
- This appliance must be connected to the main power supply by means of a circuit breaker depending on the place where the unit is installed. Failure to do so may cause electrical shock.
- Follow the instructions in this installation manual to arrange the drain pipe for proper drainage from the unit. Ensure that drained water is discharged. Improper drainage can result is water leakage, causing water damage to furniture.
- Tighten the flare nut with a torque wrench using the prescribed method. Do not apply excess torque. Otherwise, the nut may crack after a long period of usage and it may cause the leakage of refrigerant.
- Wear gloves (heavy gloves such as cotton gloves) for installation work. Failure to do so may cause personal injury when handling parts with sharp edges.
- Do not touch the air intake section or the aluminum fins of the outdoor unit. It may cause injury.
- Do not install the outdoor unit in a place which can be a nest for small animals. Small animals could enter and contact internal electrical parts, causing a failure or fire.
- Request the user to keep the place around the unit tidy and clean.
- Make sure to conduct a trial operation after the installation work, and explain how to use and maintain the unit to the customer in accordance with the manual. Ask the customer to keep the operation manual along with the installation manual.

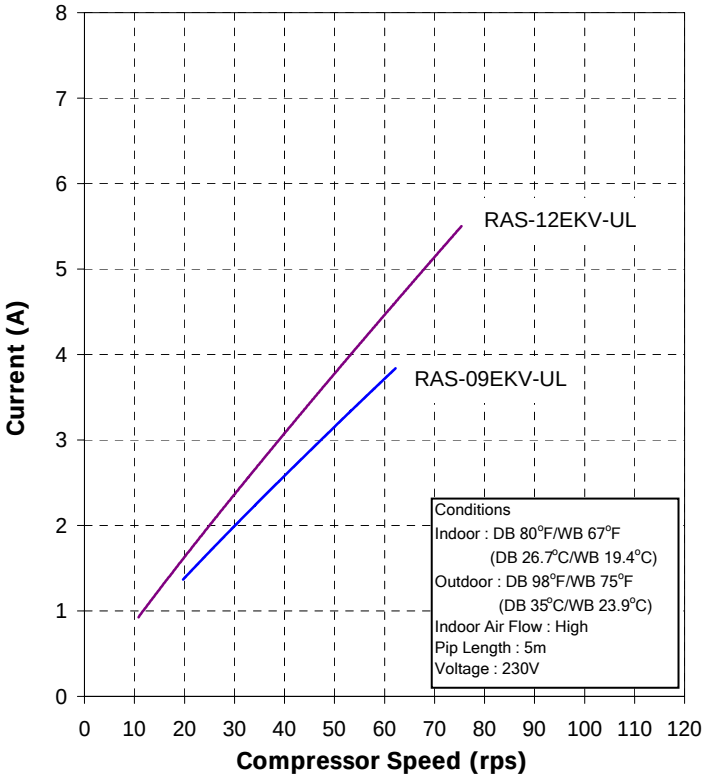
2. SPECIFICATIONS

Unit model	Indoor			**RAS-09EKV-UL**		**RAS-12EKV-UL**	
	Outdoor			**RAS-09EAV-UL, RAS-09EAV2-UL**		**RAS-12EAV-UL, RAS-12EAV2-UL**	
Cooling capacity			(Btu/h)	9000		12000	
Cooling capacity range			(Btu/h)	3750 -10580		2750 - 13950	
Heating capacity			(Btu/h)	10800		14200	
Heating capacity range			(Btu/h)	3070 - 16350		3070 - 19000	
Power supply				1Ph, 60Hz, 208V/230V		1Ph, 60Hz, 208V/230V	
Electric characteristic	Indoor	Operation mode		**Cooling**	**Heating**	**Cooling**	**Heating**
		Running current (208-230V)	(A)	0.22-0.20	0.25-0.23	0.22-0.20	0.25-0.23
		Power consumption (208-230V)	(W)	35	40	30	35
		Power factor	(%)	76	76	66	66
	Outdoor	Operation mode		**Cooling**	**Heating**	**Cooling**	**Heating**
		Running current (208-230V)	(A)	3.46-3.13	3.88-3.51	4.59-4.15	5.26-4.76
		Power consumption (208-230V)	(W)	655	760	920	1055
		Power factor	(%)	91	94	96	96
		Starting current (208-230V)	(A)	3.68-3.30	4.13-3.74	4.81-4.35	5.51/4.99
EER (Cooling/Heating)			(Btu/W.h)	13.0	13.5	12.6	13.0
SEER or HSPF			(Btu/W.h)	20.0	10.0	23.0	9.7
Operating noise	Indoor	High (Cooling/Heating)	(dB-A)	39/40		45/46	
		Medium (Cooling/Heating)	(dB-A)	34/35		40/41	
		Low (Cooling/Heating)	(dB-A)	27/29		30/32	
	Outdoor	(Cooling/Heating)	(dB-A)	47/47		50/50	
Indoor unit	Unit model			**RAS-09EKV-UL**		**RAS-12EKV-UL**	
	Dimension	Height	in. (mm)	10-25/32 (275)		10-25/32 (275)	
		Width	in. (mm)	31-1/8 (790)		31-1/8 (790)	
		Depth	in. (mm)	8-1/16 (205)		8-1/16 (205)	
	Net weight		lbs (kg)	20 (9)		20 (9)	
	Fan motor output		(W)	20		30	
	Air flow rate	(Cooling/Heating)	cfm (m^3/min)	303/335 (8.6)/(9.5)		406/438 (11.5/12.4)	
Outdoor unit	Unit model			**RAS-09EAV-UL, RAS-09EAV2-UL**		**RAS-12EAV-UL, RAS-12EAV2-UL**	
	Dimension	Height	in. (mm)	21-11/16 (550)		21-11/16 (550)	
		Width	in. (mm)	30-11/16 (780)		30-11/16 (780)	
		Depth	in. (mm)	11-7/16 (290)		11-7/16 (290)	
	Net weight		lbs (kg)	82 (37)		88 (40)	
	Compressor	Motor output	(w)	750		750	
		Type		Single rotary type with DC-inverter variable speed control		Twin rotary type with DC-inverter variable speed control	
		Model		DA89X1C-23FZ2		DA111A1F-20F1	
	Fan motor output		(W)	40		40	
	Air flow rate	(Cooling/Heating)	cfm (m^3/min)	1060/1060 (30)/(30)		1395/1236 (39.5/35.0)	
Piping connection	Type			Flare connection		Flare connection	
	Indoor unit	Liquid side	in. (mm)	∅1/4 (∅6.35)		∅1/4 (∅6.35)	
		Gas side	in. (mm)	∅3/8 (∅9.92)		∅3/8 (∅9.92)	
	Outdoor unit	Liquid side	in. (mm)	∅1/4 (∅6.35)		∅1/4 (∅6.35)	
		Gas side	in. (mm)	∅3/8 (∅9.92)		∅3/8 (∅9.92)	
	Maximum length		ft. (m)	66 (20)		66 (20)	
	Maximum chargeless length		ft. (m)	50 (15)		50 (15)	
	Maximum height difference		ft. (m)	33 (10)		33 (10)	
Refrigerant	Name of refrigerant			R410A		R410A	
	Weight		lbs (kg)	1.77 (0.8)		2.43 (1.10)	
Wiring connection	Power supply			3Wires:includes earth (Outdoor)		3Wires:includes earth (Outdoor)	
	Interconnection			4Wires:includes earth		4Wires:includes earth	
Usable temperature range	Indoor	(Cooling/Heating)		70°F-90°F (21°C-32°C) / 32°F-82°F (0°C-28°C)			
	Outdoor	(Cooling/Heating)		0°F-115°F (-18°C-46°C) / -4°F-75°F (-20°C-24°C)			

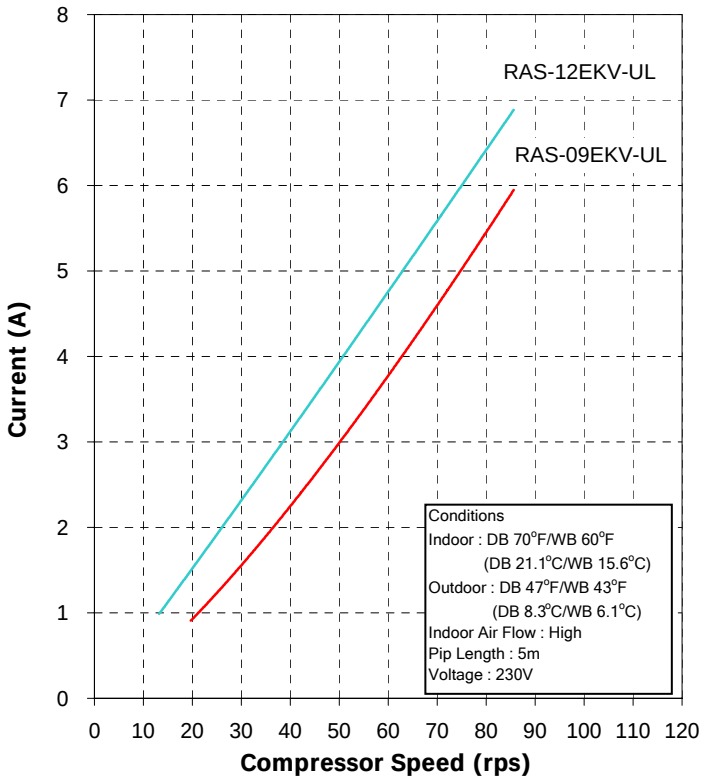
* The specifications may be subject to change without notice for purpose of improvement.

2-2. Operation Characteristic Curve

<Cooling>

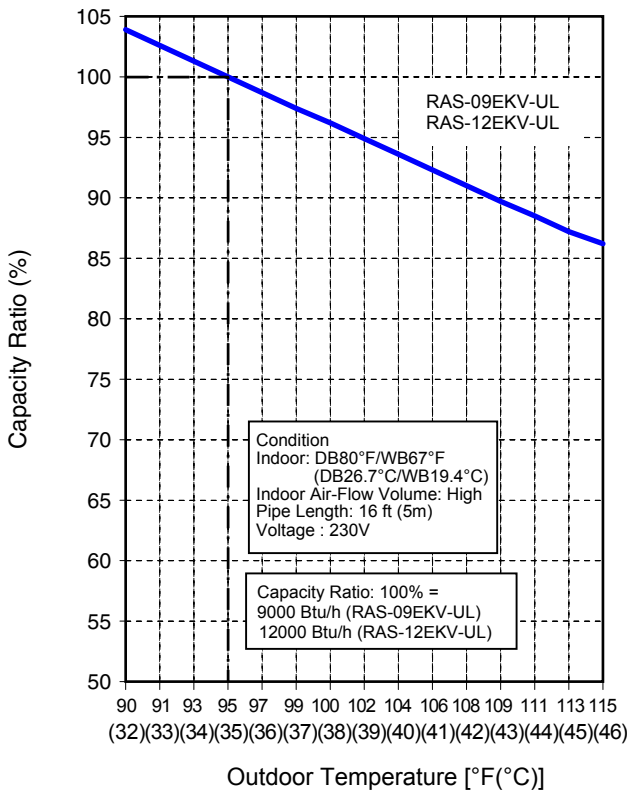


<Heating>



2-3. Capacity Variation Ratio According to Temperature

<Cooling>



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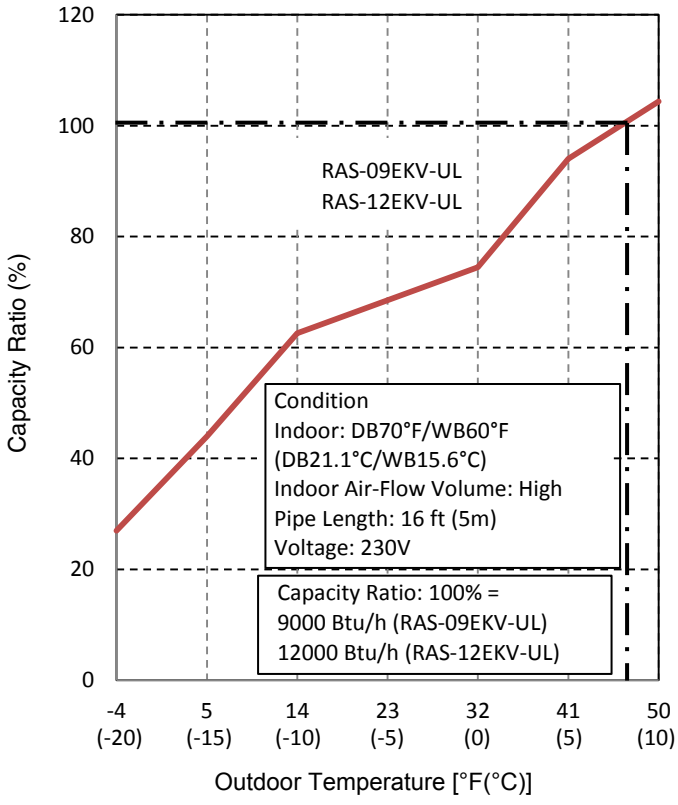


3. REFRIGERANT R410A

This air conditioner adopts the new refrigerant HFC (R410A) which does not damage the ozone layer.

The working pressure of the new refrigerant R410A is 1.6 times higher than conventional refrigerant (R22). The refrigerating oil is also changed in accordance with change of refrigerant, so be careful that water, dust, and existing refrigerant or refrigerating oil are not entered in the refrigerant cycle of the air conditioner using the new refrigerant during installation work or servicing time.

The next section describes the precautions for air conditioner using the new refrigerant. Conforming to contents of the next section together with the general cautions included in this manual, perform the correct and safe work.

3-1. Safety During Installation/Servicing

As R410A's pressure is about 1.6 times higher than that of R22, improper installation/servicing may cause a serious trouble. By using tools and materials exclusive for R410A, it is necessary to carry out installation/servicing safely while taking the following precautions into consideration.

1. Never use refrigerant other than R410A in an air conditioner which is designed to operate with R410A.

   If other refrigerant than R410A is mixed, pressure in the refrigeration cycle becomes abnormally high, and it may cause personal injury, etc. by a rupture.
2. Confirm the used refrigerant name, and use tools and materials exclusive for the refrigerant R410A.

   The refrigerant name R410A is indicated on the visible place of the outdoor unit of the air conditioner using R410A as refrigerant. To prevent mischarging, the diameter of the service port differs from that of R22.
3. If a refrigeration gas leakage occurs during installation/servicing, be sure to ventilate fully.

   If the refrigerant gas comes into contact with fire, a poisonous gas may occur.
4. When installing or removing an air conditioner, do not allow air or moisture to remain in the refrigeration cycle. Otherwise, pressure in the refrigeration cycle may become abnormally high so that a rupture or personal injury may be caused.
5. After completion of installation work, check to make sure that there is no refrigeration gas leakage.

   If the refrigerant gas leaks into the room, coming into contact with fire in the fan-driven heater, space heater, etc., a poisonous gas may occur.
6. When an air conditioning system charged with a large volume of refrigerant is installed in a small room, it is necessary to exercise care so that, even when refrigerant leaks, its concentration does not exceed the marginal level.

   If the refrigerant gas leakage occurs and its concentration exceeds the marginal level, an oxygen starvation accident may result.
7. Be sure to carry out installation or removal according to the installation manual.

   Improper installation may cause refrigeration trouble, water leakage, electric shock, fire, etc.
8. Unauthorized modifications to the air conditioner may be dangerous. If a breakdown occurs please call a qualified air conditioner technician or electrician.

   Improper repair's may result in water leakage, electric shock and fire, etc.

3-2. Refrigerant Piping Installation

3-2-1. Piping Materials and Joints Used

For the refrigerant piping installation, copper pipes and joints are mainly used. Copper pipes and joints suitable for the refrigerant must be chosen and installed. Furthermore, it is necessary to use clean copper pipes and joints whose interior surfaces are less affected by contaminants.

1. Copper Pipes

It is necessary to use seamless copper pipes which are made of either copper or copper alloy and it is desirable that the amount of residual oil is less than 40 mg/10 m. Do not use copper pipes having a collapsed, deformed or discolored portion (especially on the interior surface).

Otherwise, the expansion valve or capillary tube may become blocked with contaminants.

As an air conditioner using R410A incurs pressure higher than when using R22, it is necessary to choose adequate materials.

Thicknesses of copper pipes used with R410A are as shown in Table 3-2-1. Never use copper pipes thinner than 0.0315 in. (0.8 mm) even when it is available on the market.

Table 3-2-1 Thicknesses of annealed copper pipes

		Thickness in. (mm)	
Nominal diameter (in.)	**Outer diameter (mm)**	**R410A**	**R22**
1/4	6.35	0.0315 (0.80)	0.0315 (0.80)
3/8	9.52	0.0315 (0.80)	0.0315 (0.80)
1/2	12.70	0.0315 (0.80)	0.0315 (0.80)

2. Joints

For copper pipes, flare joints or socket joints are used. Prior to use, be sure to remove all contaminants.

a) Flare Joints

Flare joints used to connect the copper pipes cannot be used for pipings whose outer diameter exceeds 20 mm. In such a case, socket joints can be used.

Sizes of flare pipe ends, flare joint ends and flare nuts are as shown in Tables 3-2-3 to 3-2-6 below.

b) Socket Joints

Socket joints are such that they are brazed for connections, and used mainly for thick pipings whose diameter is larger than 0.7874 in. (20 mm).

Thicknesses of socket joints are as shown in Table 3-2-2.

Table 3-2-2 Minimum thicknesses of socket joints

Nominal diameter (in)	Reference outer diameter of copper pipe jointed (mm)	Minimum joint thickness in. (mm)
1/4	6.35	0.0197 (0.50)
3/8	9.52	0.0236 (0.60)
1/2	12.70	0.0276 (0.70)

3-2-2. Processing of Piping Materials

When performing the refrigerant piping installation, care should be taken to ensure that water or dust does not enter the pipe interior, that no other oil than lubricating oils used in the installed air-water heat pump is used, and that refrigerant does not leak. When using lubricating oils in the piping processing, use such lubricating oils whose water content has been removed. When stored, be sure to seal the container with an airtight cap or any other cover.

1. Flare processing procedures and precautions

a) Cutting the Pipe

By means of a pipe cutter, slowly cut the pipe so that it is not deformed.

b) Removing Burrs and Chips

If the flared section has chips or burrs, refrigerant leakage may occur.
Carefully remove all burrs and clean the cut surface before installation.

c) Insertion of Flare Nut

d) Flare Processing

Make certain that a clamp bar and copper pipe have been cleaned.

By means of the clamp bar, perform the flare processing correctly.

Use either a flare tool for R410A or conventional flare tool.

Flare processing dimensions differ according to the type of flare tool. When using a conventional flare tool, be sure to secure “dimension A” by using a gauge for size adjustment.

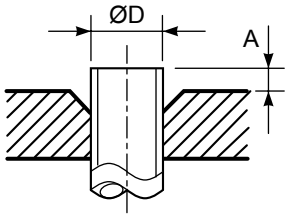


Fig. 3-2-1 Flare processing dimensions

Table 3-2-3 Dimensions related to flare processing for R410A

Nominal diameter in.	Outer diameter (mm)	Thickness in. (mm)	A in. (mm)		
			Flare tool for R410A clutch type	Conventional flare tool	
				Clutch type	Wing nut type
1/4	6.35	0.0315 (0.8)	0 to 0.0197 (0 to 0.5)	0.0394 to 0.0591 (1.0 to 1.5)	0.0591 to 0.0787 (1.5 to 2.0)
3/8	9.52	0.0315 (0.8)	0 to 0.0197 (0 to 0.5)	0.0394 to 0.0591 (1.0 to 1.5)	0.0591 to 0.0787 (1.5 to 2.0)
1/2	12.70	0.0315 (0.8)	0 to 0.0197 (0 to 0.5)	0.0394 to 0.0591 (1.0 to 1.5)	0.07874 to 0.0984 (2.0 to 2.5)

Table 3-2-4 Dimensions related to flare processingf or R22

Nominal diameter in.	Outer diameter (mm)	Thickness in. (mm)	A in. (mm)		
			Flare tool for R22 clutch type	Conventional flare tool	
				Clutch type	Wing nut type
1/4	6.35	0.0315 (0.8)	0 to 0.0197 (0 to 0.5)	0.0197 to 0.0394 (0.5 to 1.0)	0.0394 to 0.0591 (1.0 to 1.5)
3/8	9.52	0.0315 (0.8)	0 to 0.0197 (0 to 0.5)	0.0197 to 0.0394 (0.5 to 1.0)	0.0394 to 0.0591 (1.0 to 1.5)
1/2	12.70	0.0315 (0.8)	0 to 0.0197 (0 to 0.5)	0.0197 to 0.0394 (0.5 to 1.0)	0.0591 to 0.0787 (1.5 to 2.0)

Table 3-2-5 Flare and flare nut dimensions for R410A

Nominal diameter in.	Outer diameter (mm)	Thic kness in. (mm)	Dimension in. (mm)				Flare nut width in. (mm)
			A	B	C	D	
1/4	6.35	0.0315 (0.8)	0.358 (9.1)	0.362 (9.2)	0.256 (6.5)	0.512 (13)	0.669 (17)
3/8	9.52	0.0315 (0.8)	0.520 (13.2)	0.531 (13.5)	0.382 (9.7)	0.787 (20)	0.866 (22)
1/2	12.70	0.0315 (0.8)	0.630 (16.0)	0.653 (16.6)	0.508 (12.9)	0.906 (23)	1.024 (26)

Table 3-2-6 Flare and flare nut dimensions for R22

Nominal diameter in.	Outer diameter (mm)	Thickness in. (mm)	Dimension in. (mm)				Flare nut width in. (mm)
			A	B	C	D	
1/4	6.35	0.0315 (0.8)	0.354 (9.0)	0.362 (9.2)	0.256 (6.5)	0.512 (13)	0.669 (17)
3/8	9.52	0.0315 (0.8)	0.512 (13.0)	0.531 (13.5)	0.382 (9.7)	0.787 (20)	0.866 (22)
1/2	12.70	0.0315 (0.8)	0.630 (16.0)	0.638 (16.2)	0.508 (12.9)	0.787 (20)	0.945 (24)

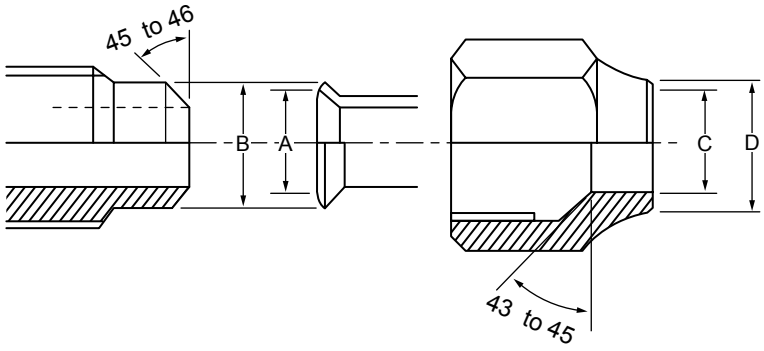


Fig. 3-2-2 Relations between flare nut and flare seal surface

2. Flare Connecting Procedures and Precautions

a) Make sure that the flare and union portions do not have any scar or dust, etc.

b) Correctly align the processed flare surface with the union axis.

c) Tighten the flare with designated torque by means of a torque wrench. The tightening torque for R410A is the same as that for conventional R22. Incidentally, when the torque is weak, the gas leakage may occur. When it is strong, the flare nut may crack and may be made non-removable. When choosing the tightening torque, comply with values designated by manufacturers. Table 3-2-7 shows reference values.

NOTE :

When applying oil to the flare surface, be sure to use oil designated by the manufacturer.
If any other oil is used, the lubricating oils may deteriorate and cause the compressor to burn out.

Table 3-2-7 Tightening torque of flare for R410A [Reference values]

Nominal diameter in.	Outer diameter (mm)	Tightening torque lbf.ft (N•m)	Tightening torque of torque wrenches available on the market lbf.ft (N•m)
1/4	6.35	10 to 13 (14 to 18)	12 (16), 13 (18)
3/8	9.52	24 to 31 (33 to 42)	31 (42)
1/2	12.70	37 to 46 (50 to 62)	41 (55)

3-3. Tools

3-3-1. Required Tools

The service port diameter of packed valve of the outdoor unit in the air-water heat pump using R410A is changed to prevent mixing of other refrigerant. To reinforce the pressure-resisting strength, flare processing dimensions and opposite side dimension of flare nut (For ∅ 1/2 in. 12.7mm) copper pipe) of the refrigerant piping are lengthened.

The used refrigerating oil is changed, and mixing of oil may cause a trouble such as generation of sludge, clogging of capillary, etc. Accordingly, the tools to be used are classified into the following three types.

1. Tools exclusive for R410A (Those which cannot be used for conventional refrigerant (R22))
2. Tools exclusive for R410A, but can be also used for conventional refrigerant (R22)
3. Tools commonly used for R410A and for conventional refrigerant (R22)

The table below shows the tools exclusive for R410A and their interchangeability.

Tools exclusive for R410A (The following tools for R410A are required.)

Tools whose specifications are changed for R410A and their interchangeability

No.	Used tool	Usage	R410A air-water heat pump installation		Conventional air-water heat pump installation
			Existence of new equipment for R410A	Whether conventional equipment can be used	Whether new equipment can be used with conventional refrigerant
1	Flare tool	Pipe flaring	Yes	***(Note 1)**	○
2	Copper pipe gauge for adjusting projection margin	Flaring by conventional flare tool	Yes	***(Note 1)**	***(Note 1)**
3	Torque wrench [(For Ø1/2 (12.7mm)]	Connection of flare nut	Yes	×	×
4	Gauge manifold	Evacuating, refrigerant charge, run check, etc.	Yes	×	×
5	Charge hose				
6	Vacuum pump adapter	Vacuum evacuating	Yes	×	○
7	Electronic balance for refrigerant charging	Refrigerant charge	Yes	×	○
8	Refrigerant cylinder	Refrigerant charge	Yes	×	×
9	Leakage detector	Gas leakage check	Yes	×	○
10	Charging cylinder	Refrigerant charge	**(Note 2)**	×	×

(Note 1) When flaring is carried out for R410A using the conventional flare tools, adjustment of projection margin is necessary. For this adjustment, a copper pipe gauge, etc. are necessary.

(Note 2) Charging cylinder for R410A is being currently developed.

General tools (Conventional tools can be used.)

In addition to the above exclusive tools, the following equipments which serve also for R22 are necessary as the general tools.

1. Vacuum pump
   Use vacuum pump by attaching vacuum pump adapter.
2. Torque wrench [For Ø1/4, Ø3/8 in. (∅6.35, ∅9.52mm)]
3. Pipe cutter
4. Reamer
5. Pipe bender
6. Level vial
7. Screwdriver (+, –)
8. Spanner or Monkey wrench
9. Hole core drill [Ø2-9/16 in. (65mm)]
10. Hexagon wrench [Opposite side 3/16 in. (4mm)]
11. Tape measure
12. Metal saw

Also prepare the following equipments for other installation method and run check.

1. Clamp meter
2. Thermometer
3. Insulation resistance tester
4. Electroscope

3-4. Recharging of Refrigerant

When it is necessary to recharge refrigerant, charge the specified amount of new refrigerant according to the following steps.

Recover the refrigerant, and check no refrigerant remains in the equipment.

↓

Connect the charge hose to packed valve service port at the outdoor unit's gas side.

↓

Connect the charge hose to the vacuum pump adapter.

↓

Open fully both packed valves at liquid and gas sides.

↓

Place the handle of the gauge manifold Low in the fully opened position, and turn on the vacuum pump's power switch. Then, evacuating the refrigerant in the cycle.

↓

When the compound gauge's pointer has indicated −14.7 Psi (–0.1 Mpa) or −29.9 inHg (–76 cmHg), place the handle Low in the fully closed position, and turn off the vacuum pump's power switch.

↓

Keep the status as it is for 1 to 2 minutes, and ensure that the compound gauge's pointer does not return.

↓

Set the refrigerant cylinder to the electronic balance, connect the connecting hose to the cylinder and the connecting port of the electronic balance, and charge **liquid refrigerant**.

(For refrigerant charging, see the figure below.)

1. Never charge refrigerant exceeding the specified amount.
2. If the specified amount of refrigerant cannot be charged, charge refrigerant **bit by bit** in COOL mode.
3. Do not carry out additional charging.
   When additional charging is carried out if refrigerant leaks, the refrigerant composition changes in the refrigeration cycle, that is characteristics of the air conditioner changes, refrigerant exceeding the specified amount is charged, and working pressure in the refrigeration cycle becomes abnormally high pressure, and may cause a rupture or personal injury.

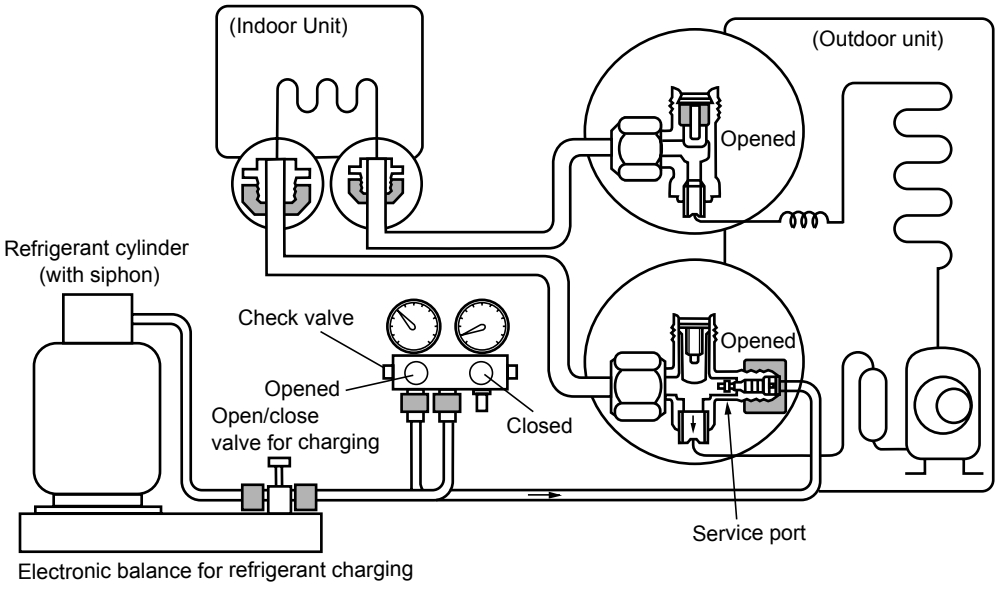
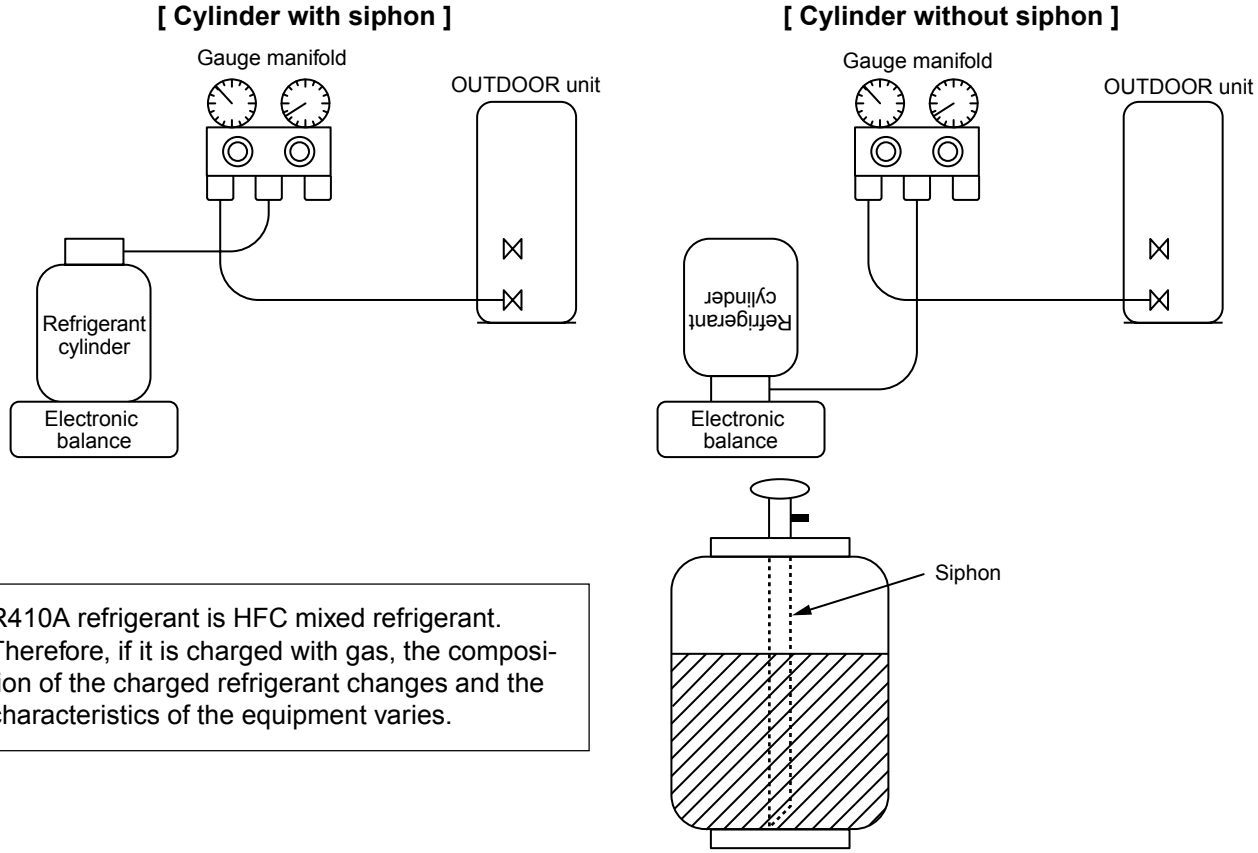


Fig. 3-4-1 Configuration of refrigerant charging

1. Be sure to make setting so that **liquid** can be charged.
2. When using a cylinder equipped with a siphon, liquid can be charged without turning it upside down.

It is necessary for charging refrigerant under condition of liquid because R410A is mixed type of refrigerant. Accordingly, when charging refrigerant from the refrigerant cylinder to the equipment, charge it turning the cylinder upside down if cylinder is not equipped with siphon.



R410A refrigerant is HFC mixed refrigerant. Therefore, if it is charged with gas, the composition of the charged refrigerant changes and the characteristics of the equipment varies.

Fig. 3-4-2

3-5. Brazing of Pipes

3-5-1. Materials for Brazing

1. Silver brazing filler

Silver brazing filler is an alloy mainly composed of silver and copper. It is used to join iron, copper or copper alloy, and is relatively expensive though it excels in solderability.

2. Phosphor bronze brazing filler

Phosphor bronze brazing filler is generally used to join copper or copper alloy.

3. Low temperature brazing filler

Low temperature brazing filler is generally called solder, and is an alloy of tin and lead. Since it is weak in adhesive strength, do not use it for refrigerant pipes.

1. Phosphor bronze brazing filler tends to react with sulfur and produce a fragile compound water solution, which may cause a gas leakage. Therefore, use any other type of brazing filler at a hot spring resort, etc., and coat the surface with a paint.
2. When performing brazing again at time of servicing, use the same type of brazing filler.

3-5-2. Flux

1. Reason why flux is necessary

- By removing the oxide film and any foreign matter on the metal surface, it assists the flow of brazing filler.
- In the brazing process, it prevents the metal surface from being oxidized.
- By reducing the brazing filler's surface tension, the brazing filler adheres better to the treated metal.

2. Characteristics required for flux

- Activated temperature of flux coincides with the brazing temperature.
- Due to a wide effective temperature range, flux is hard to carbonize.
- It is easy to remove slag after brazing.
- The corrosive action to the treated metal and brazing filler is minimum.
- It excels in coating performance and is harmless to the human body.

As the flux works in a complicated manner as described above, it is necessary to select an adequate type of flux according to the type and shape of treated metal, type of brazing filler and brazing method, etc.

3. Types of flux

- **Noncorrosive flux**

  Generally, it is a compound of borax and boric acid.
  It is effective in case where the brazing temperature is higher than 1472°F (800°C).

- **Activated flux**

  Most of fluxes generally used for silver brazing are this type.
  It features an increased oxide film removing capability due to the addition of compounds such as potassium fluoride, potassium chloride and sodium fluoride to the borax-boric acid compound.

4. Piping materials for brazing and used brazing filler/flux

Piping material	Used brazing filler	Used flux
Copper - Copper	Phosphor copper	Do not use
Copper - Iron	Silver	Paste flux
Iron - Iron	Silver	Vapor flux

1. Do not enter flux into the refrigeration cycle.
2. When chlorine contained in the flux remains within the pipe, the lubricating oil deteriorates. Therefore, use a flux which does not contain chlorine.
3. When adding water to the flux, use water which does not contain chlorine (e.g. distilled water or ion-exchange water).
4. Remove the flux after brazing.

3-5-3. Brazing

As brazing work requires sophisticated techniques, experiences based upon a theoretical knowledge, it must be performed by a person qualified.

In order to prevent the oxide film from occurring in the pipe interior during brazing, it is effective to proceed with brazing while letting dry Nitrogen gas (N2) flow.

Never use gas other than Nitrogen gas.

1. Brazing method to prevent oxidation

1) Attach a reducing valve and a flow-meter to the Nitrogen gas cylinder.
2) Use a copper pipe to direct the piping material, and attach a flow-meter to the cylinder.
3) Apply a seal onto the clearance between the piping material and inserted copper pipe for Nitrogen in order to prevent backflow of the Nitrogen gas.
4) When the Nitrogen gas is flowing, be sure to keep the piping end open.
5) Adjust the flow rate of Nitrogen gas so that it is lower than 0.03 cfm (0.05 m^3/Hr) or 2.9 Psi (0.02 MPa) by means of the reducing valve.
6) After performing the steps above, keep the Nitrogen gas flowing until the pipe cools down to a certain extent (temperature at which pipes are touchable with hands).
7) Remove the flux completely after brazing.

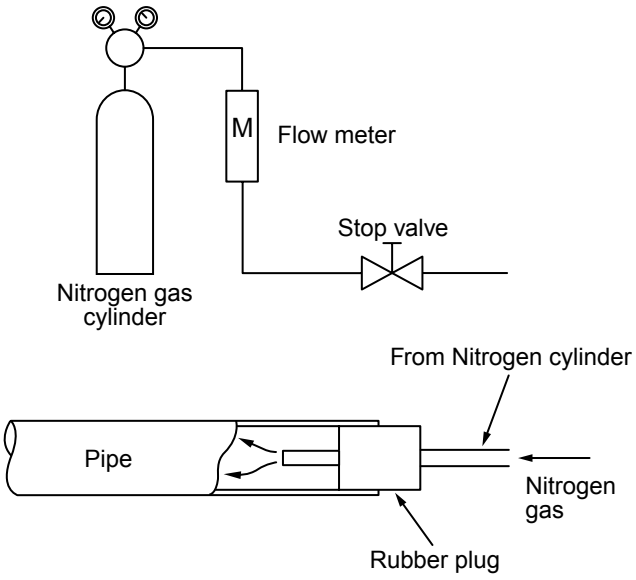
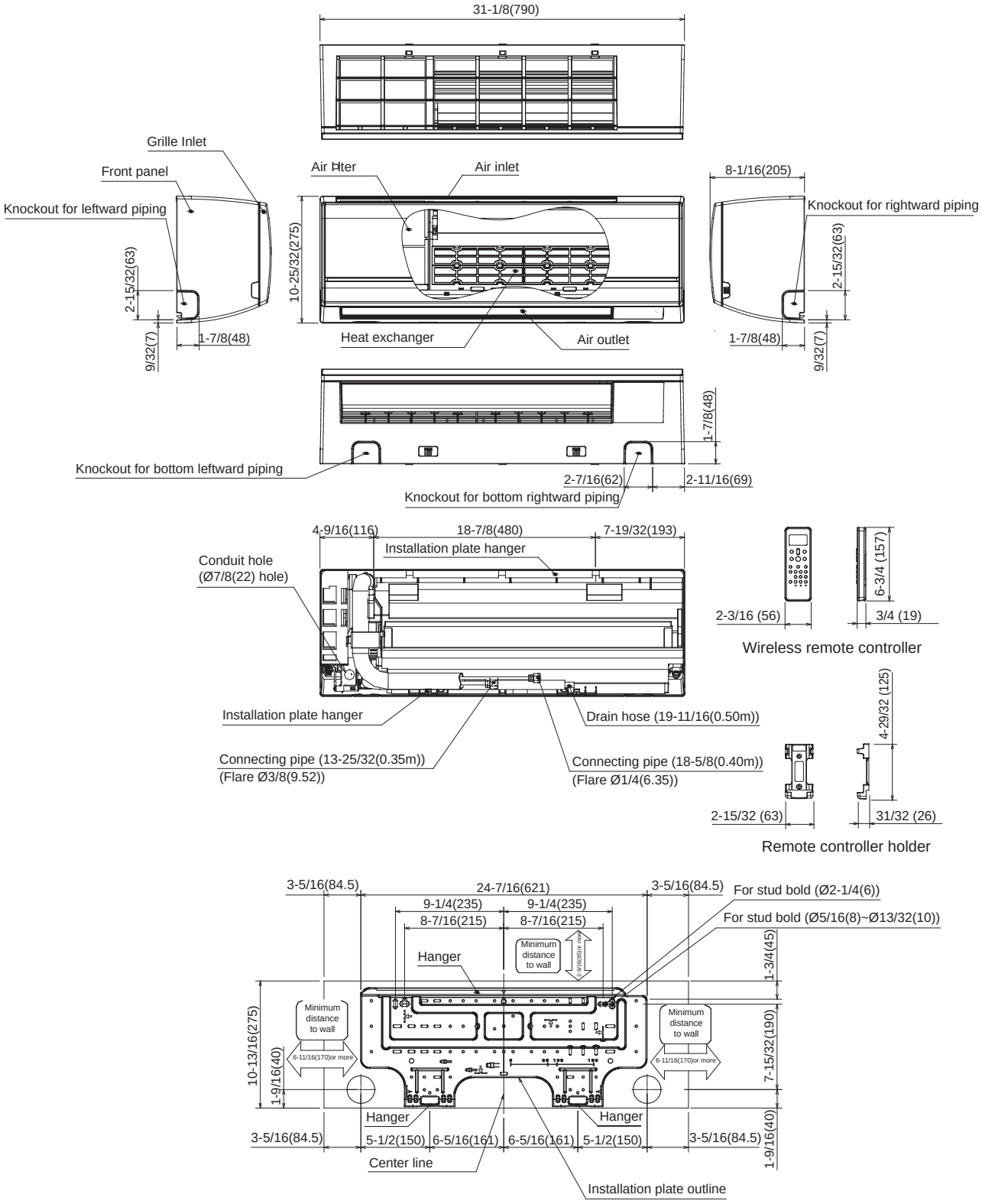


Fig. 3-5-1 Prevention of oxidation during brazing

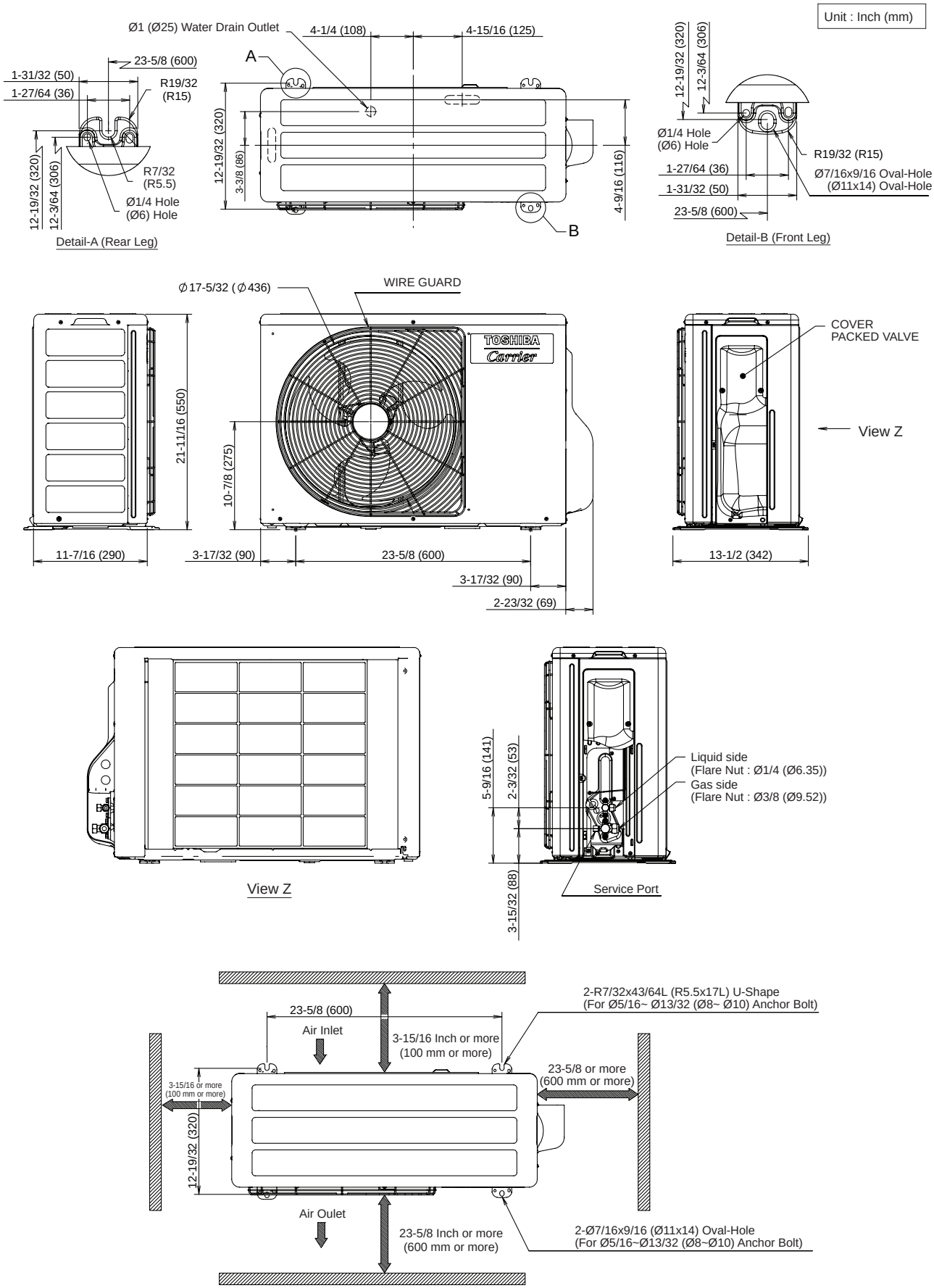
4. CONSTRUCTION VIEWS

4-1. Indoor Unit

Unit : Inch (mm)

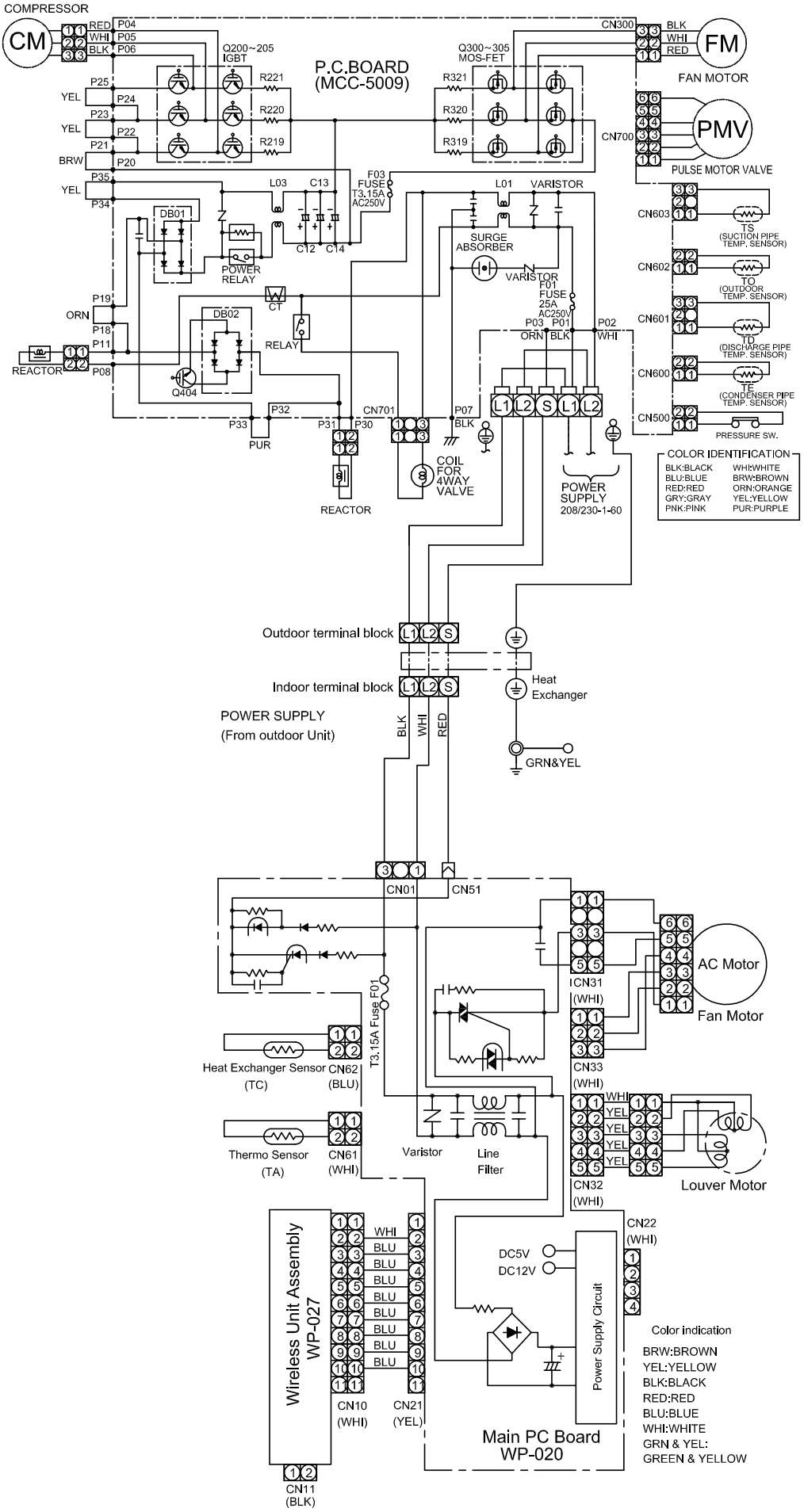


4-2. Outdoor Unit

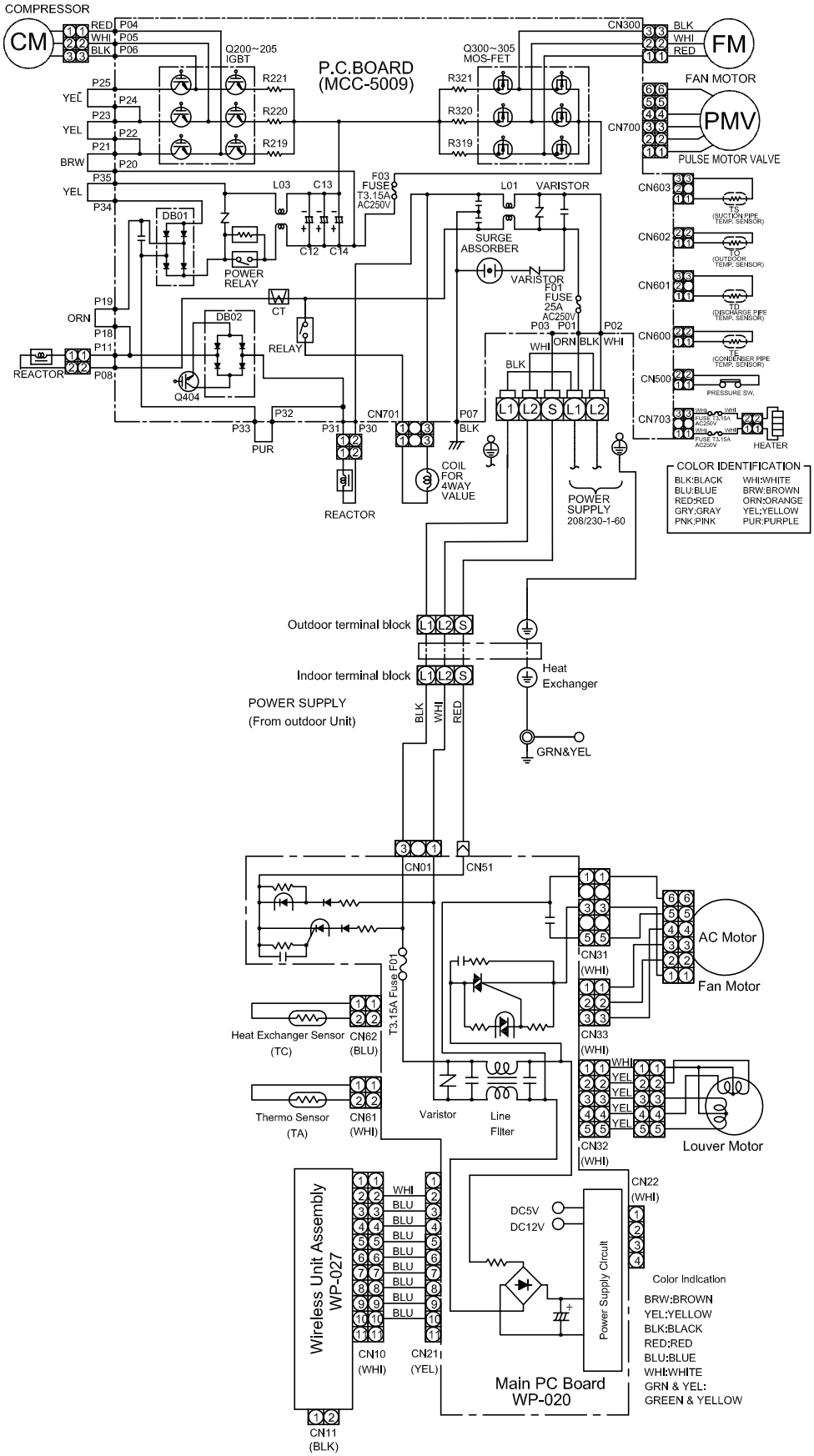


5. WIRING DIAGRAM

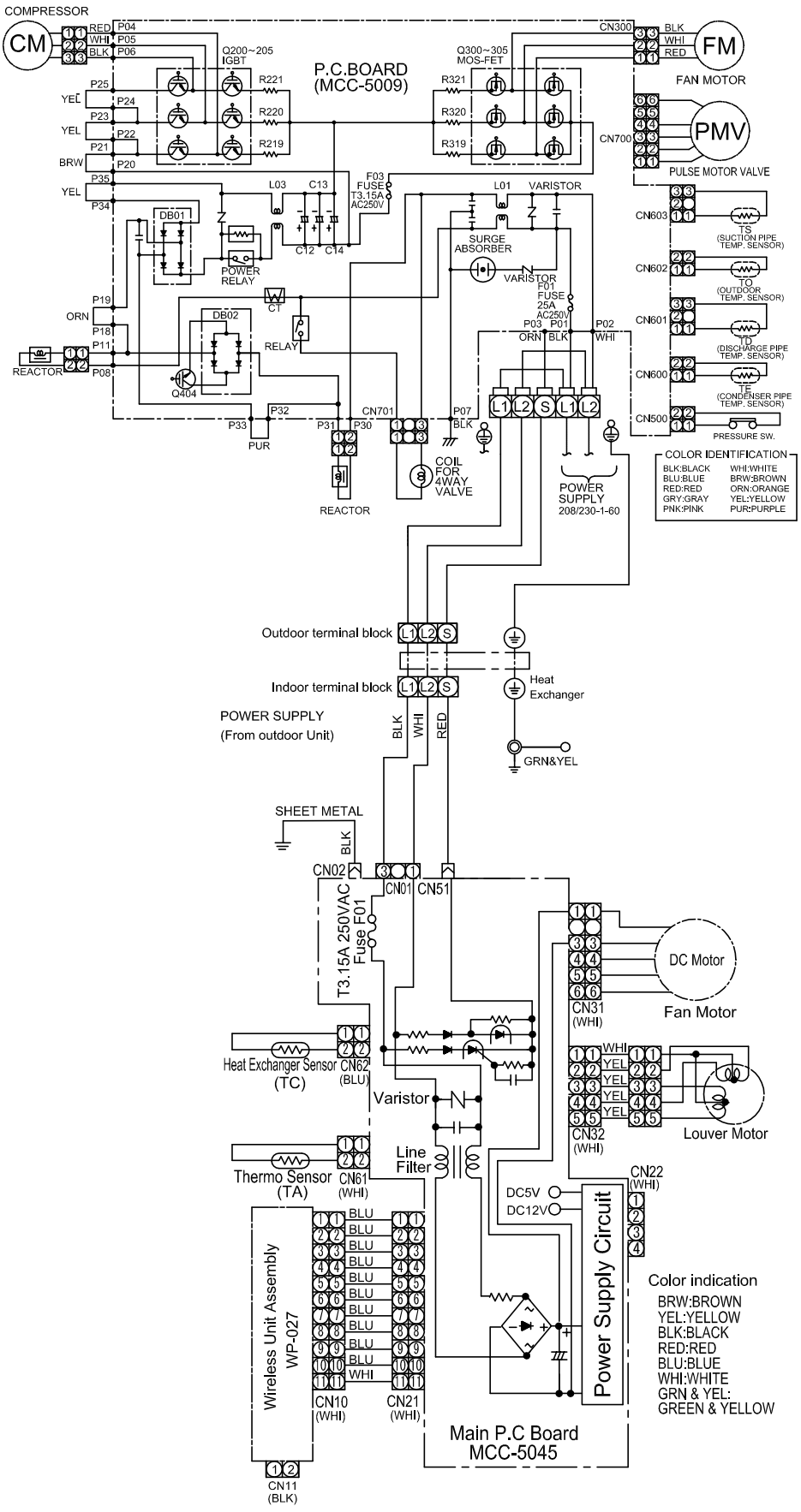
5-1. RAS-09EKV-UL / RAS-09EAV-UL



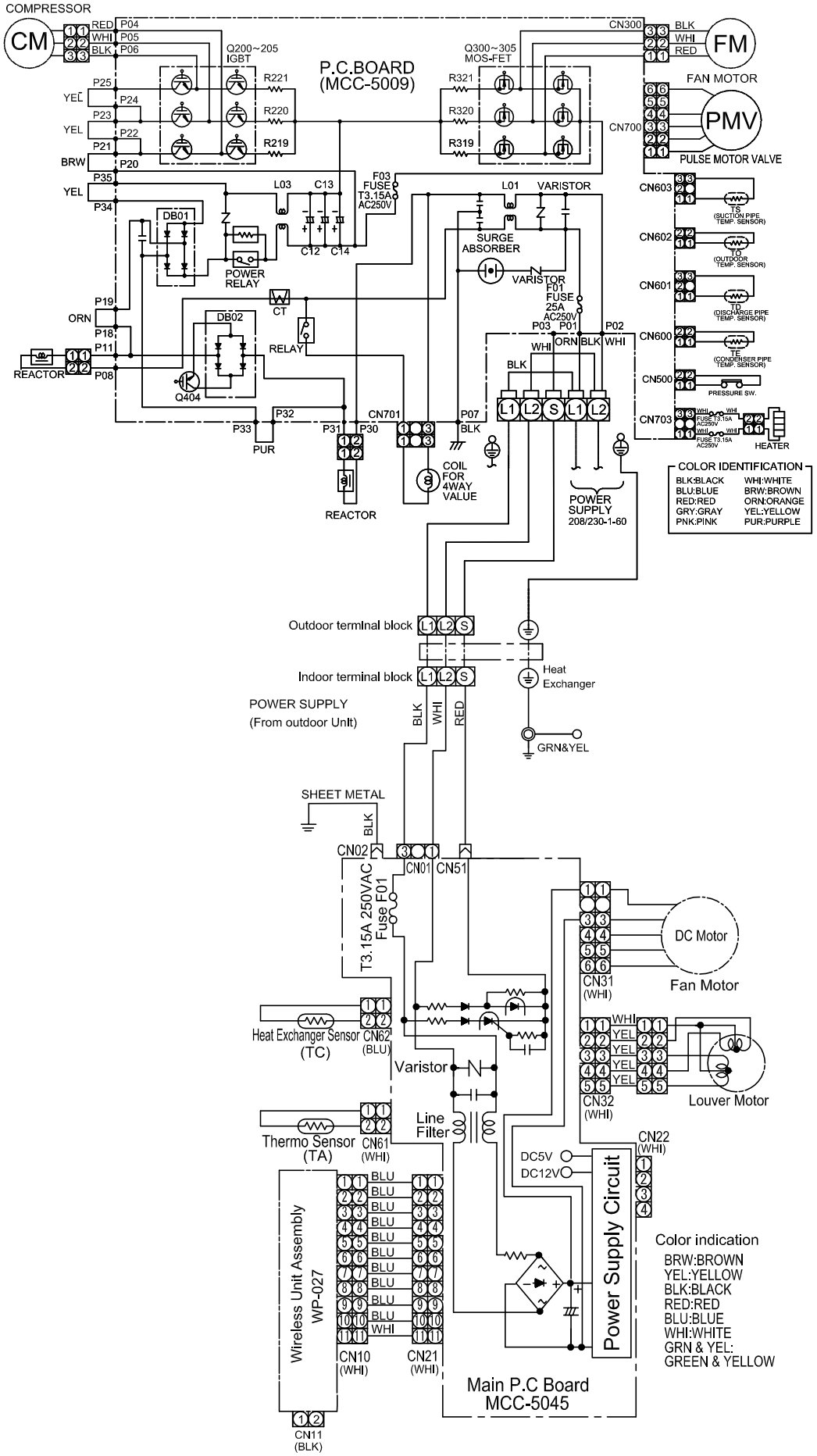
5-2. RAS-09EKV-UL / RAS-09EAV2-UL



5-3. RAS-12EKV-UL / RAS-12EAV-UL



5-4. RAS-12EKV-UL / RAS-12EAV2-UL



6. SPECIFICATIONS OF ELECTRICAL PARTS

6-1. Indoor Unit

No.	Parts name		Type	Specifications
1	Fan motor (for indoor)	RAS-09EK Series	RPG-240-25A	AC240V, 25W
		RAS-12EK Series	ICF-340U30-2	AC220V, 30W
2	Room temp. sensor (TA-sensor)		(–)	10kΩ at 25°C
3	Heat exchanger temp. sensor (TC-sensor)		(–)	10kΩ at 25°C
4	Louver motor		24BYJ48-HTP	Output (Rated) 1W, 16 poles, DC12V

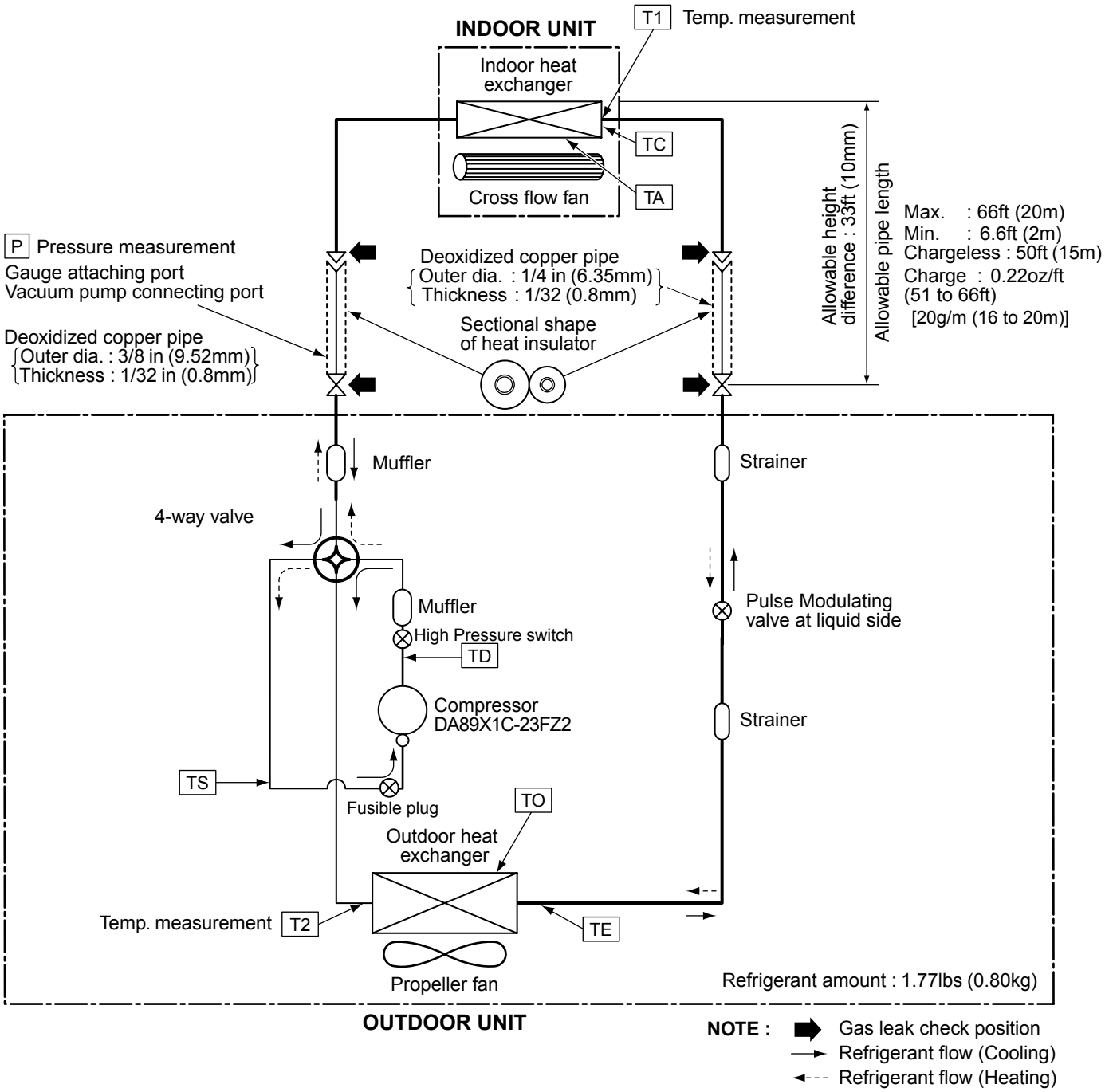
6-2. Outdoor Unit

No.	Parts name		Model name	Rating
1	Reactor		CH-57-Z-T	L = 10mH, 16A
2	Outdoor fan motor		ICF-340UA40-2	DC340V, 40W
3	Suction temp. sensor (TS sensor)		(Inverter attached)	10kΩ (25°C)
4	Discharge temp. sensor (TD sensor)		(Inverter attached)	62kΩ (20°C)
5	Outside air temp. sensor (TO sensor)		(Inverter attached)	10kΩ (25°C)
6	Heat exchanger temp. sensor (TE sensor)		(Inverter attached)	10kΩ (25°C)
7	Terminal block (5P)		———	30A, AC600V
8	Compressor	RAS-09EA Series	DA89X1C-23FZ2	3-phases 4-poles 680W
		RAS-12EA Series	DA111A1F-20F2	3-phases 4-poles 750W
9	COIL FOR P.M.V.		CAM-MD 12TCTH-4	DC12V
10	Coil for 4-way valve		STF-01U8Z	
11	Pressure SW.		ACB-4UB82W	4.7 MPa

7. REFRIGERANT CYCLE DIAGRAM

7-1. Refrigerant Cycle Diagram

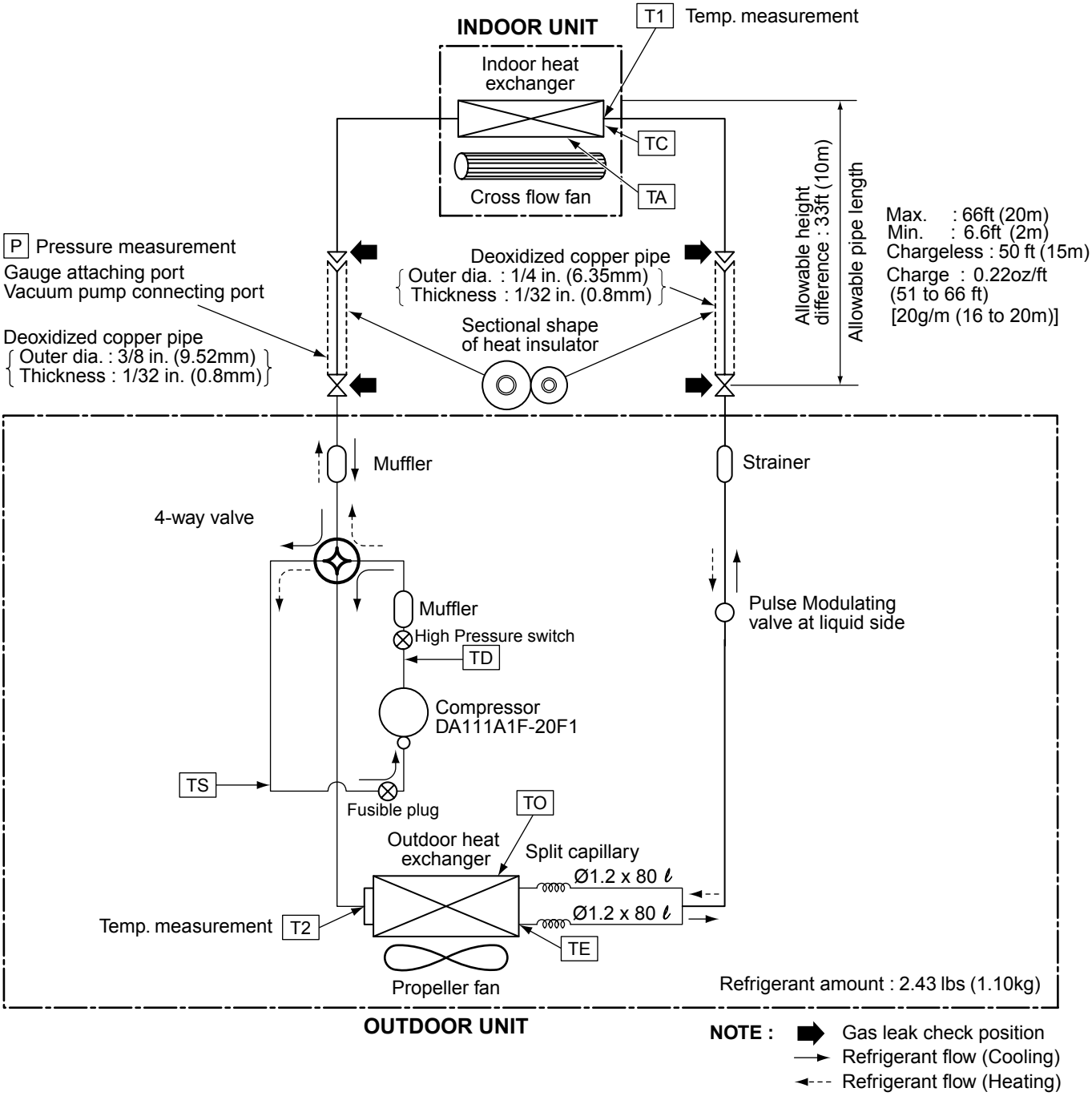
RAS-09EKV-UL / RAS-09EAV-UL
RAS-09EKV-UL / RAS-09EAV2-UL



NOTE :

- The maximum pipe length of this air conditioner is 66ft (20 m). When the pipe length exceeds 50ft (15m), the additional charging of refrigerant, 0.22 oz/ft (20g/m) for the part of pipe exceeded 50ft (15m) is required. [(Max. 0.22 lbs (100g)]

RAS-12EKV-UL / RAS-12EAV-UL
RAS-12EKV-UL / RAS-12EAV2-UL



NOTE :

- The maximum pipe length of this air conditioner is 66ft (15 m). When the pipe length exceeds 50ft (15m), the additional charging of refrigerant, 0.22 oz/ft (20g/m) for the part of pipe exceeded 15m is required. [Max. 0.22 lbs (100g)]

7-2. Operation Data

<Cooling>

Tempeature condition(°C)		Model name RAS-	Standard pressure	Heat exchanger pipe temp.		Indoor fan mode	Outdoor fan mode	Compressor revolution (rps)
Indoor	Outdoor		P Psia (MPa)	T1 °F (°C)	T2 °F (°C)			
80/67 (26.7/19.4)	98/75 (35/23.9)	09EKV-UL	137 to 160 (0.9 to 1.1)	54 to 57 (12 to 14)	99 to 102 (37 to 39)	High	High	60
		12EKV-UL	116 to 145 (0.8 to 1.0)	52 to 55 (11 to 13)	104 to 107 (42 to 44)	High	High	77

<Heating>

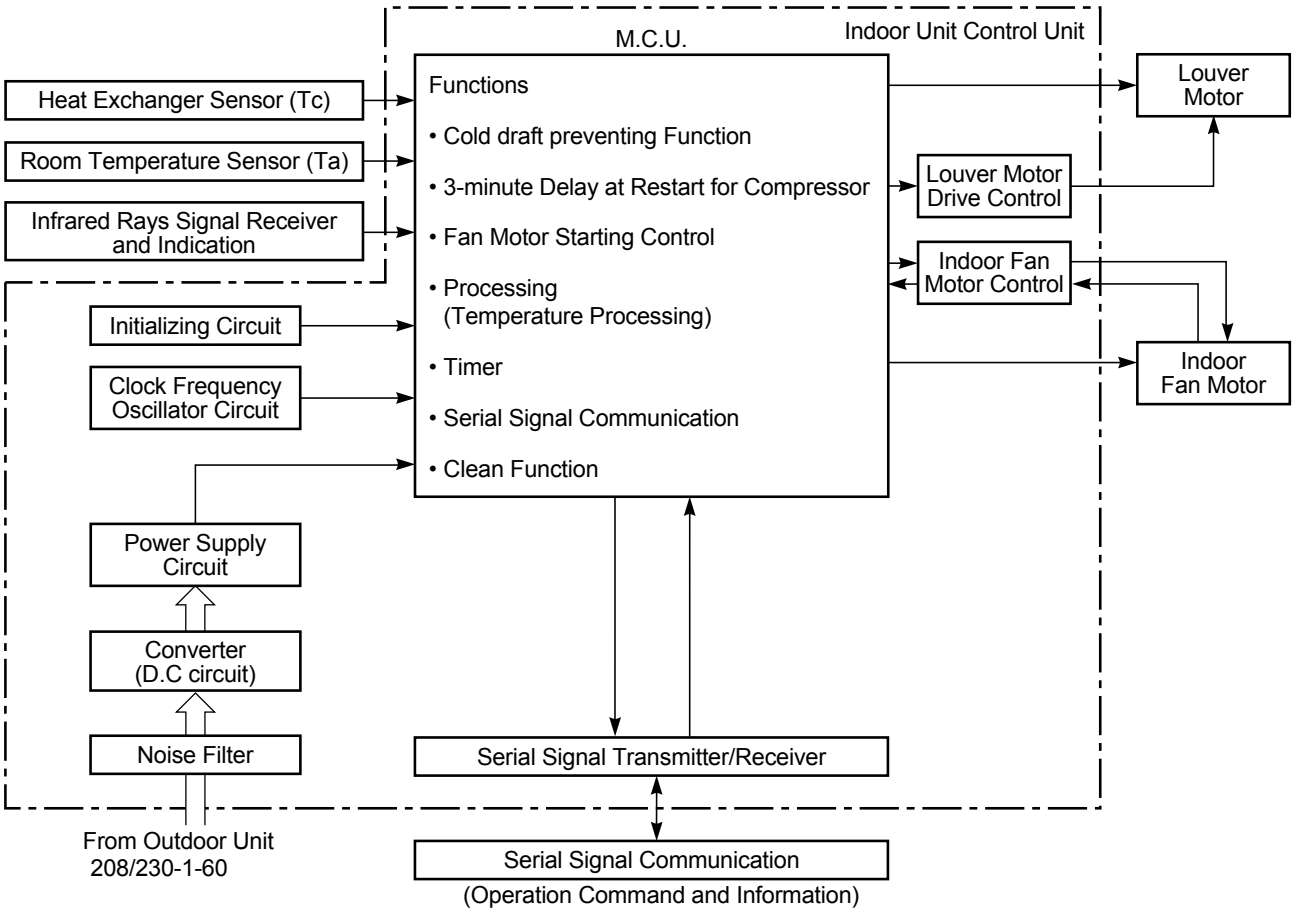
Tempeature condition(°C)		Model name RAS-	Standard pressure	Heat exchanger pipe temp.		Indoor fan mode	Outdoor fan mode	Compressor revolution (rps)
Indoor	Outdoor		P Psia (MPa)	T1 °F (°C)	T2 °F (°C)			
70/60 (21.1/15.6)	47/43 (8.3/6.1)	09EKV-UL	363 to 392 (2.5 to 2.7)	102 to 105 (39 to 41)	32 to 37 (0 to 3)	High	High	62
		12EKV-UL	377 to 406 (2.6 to 2.8)	106 to 106 (41 to 43)	32 to 36 (0 to 2)	High	High	64

NOTES :

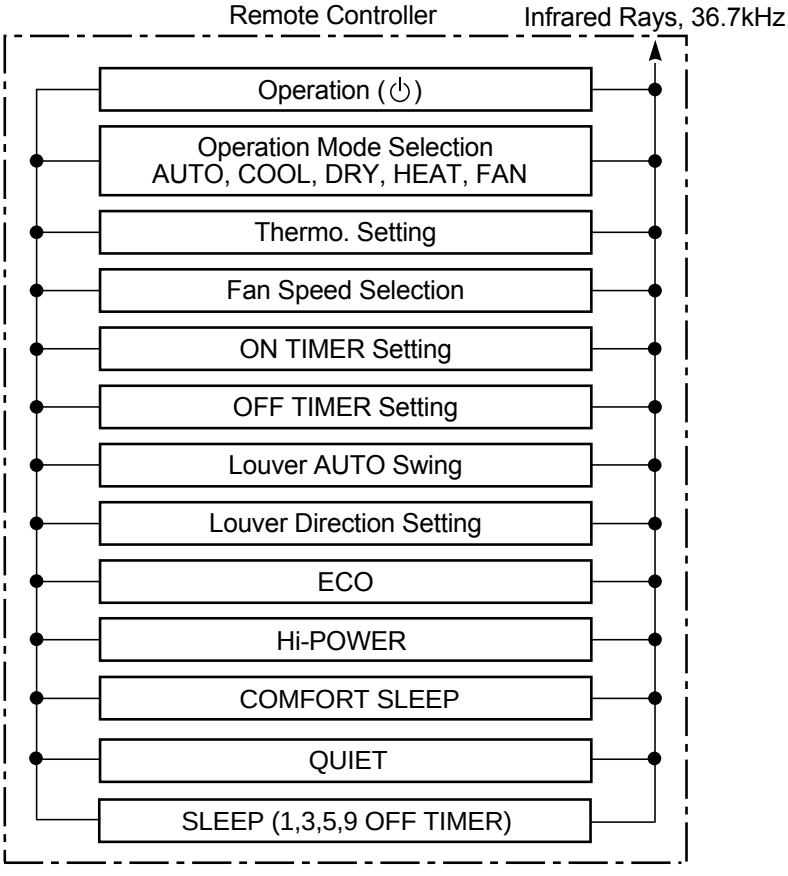
1. Measure surface temperature of heat exchanger pipe around center of heat exchaner path U bent. (Thermistor themometer)
2. Connecting piping condition : 16 ft (5m)

8. CONTROL BLOCK DIAGRAM

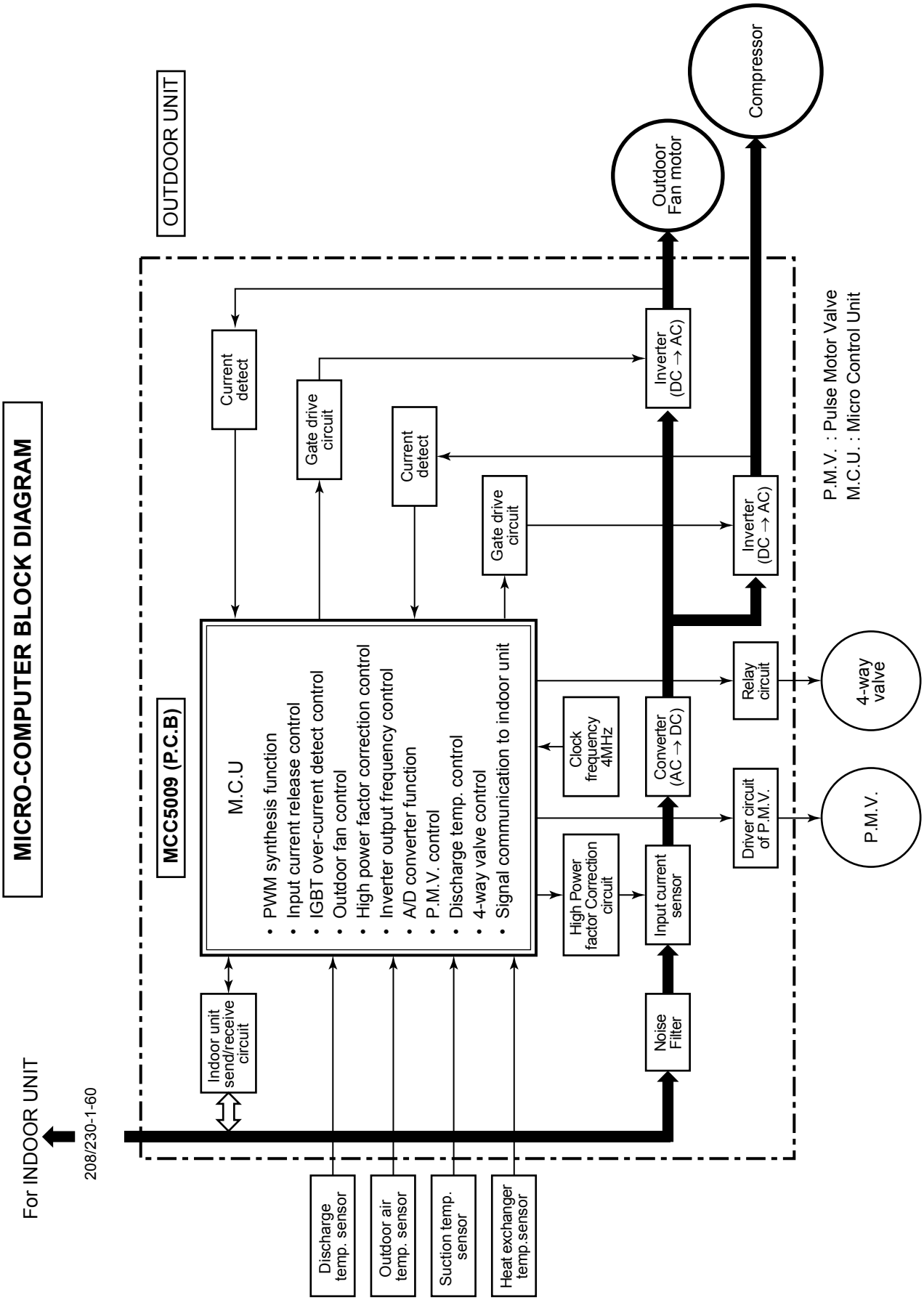
8-1. Indoor Unit



REMOTE CONTROLLER



8-2. Outdoor Unit (Inverter Assembly)



9. OPERATION DESCRIPTION

9-1. Outline of Air Conditioner Control

This air conditioner is a capacity-variable type air conditioner, which uses AC or DC motor for the indoor for motor and the outdoor fan motor. And the capacity-proportional control compressor which can change the motor speed in the range from 11 to 96 rps is mounted. The DC motor drive circuit is mounted to the indoor unit. The compressor and the inverter to control fan motor are mounted to the outdoor unit.

The entire air conditioner is mainly controlled by the indoor unit controller.

The indoor unit controller drives the indoor fan motor based upon command sent from the remote controller, and transfers the operation command to the outdoor unit controller.

The outdoor unit controller receives operation command from the indoor unit side, and controls the outdoor fan and the pulse Modulating valve. (P.M.V) Besides, detecting revolution position of the compressor motor, the outdoor unit controller controls speed of the compressor motor by controlling output voltage of the inverter and switching timing of the supply power (current transfer timing) so that motors drive according to the operation command.
And then, the outdoor unit controller transfers reversely the operating status information of the outdoor unit to control the indoor unit controller.

As the compressor adopts four-pole brushless DC motor, the frequency of the supply power from inverter to compressor is two-times cycles of the actual number of revolution.

1. Role of indoor unit controller

The indoor unit controller judges the operation commands from the remote controller and assumes the following functions.

- Judgment of suction air temperature of the indoor heat exchanger by using the indoor temp. sensor. (TA sensor)
- Judgment of the indoor heat exchanger temperature by using heat exchanger sensor (TC sensor) (Prevent-freezing control, etc.)
- Louver motor control
- Indoor fan motor operation control
- LED (Light Emitting Diode) display control
- Transferring of operation command signal (Serial signal) to the outdoor unit
- Reception of information of operation status (Serial signal including outside temp. data) to the outdoor unit and judgment/display of error
- Air purifier operation control

2. Role of outdoor unit controller

Receiving the operation command signal (Serial signal) from the indoor unit controller, the outdoor unit performs its role.

- Compressor operation control
- Operation control of outdoor fan motor
- P.M.V. control
- 4-way valve control

} Operations followed to judgment of serial signal from indoor side.

- Detection of inverter input current and current release operation
- Over-current detection and prevention operation to IGBT module (Compressor stop function)
- Compressor and outdoor fan stop function when serial signal is off (when the serial signal does not reach the board assembly of outdoor control by trouble of the signal system)
- Transferring of operation information (Serial signal) from outdoor unit controller to indoor unit controller
- Detection of outdoor temperature and operation revolution control
- Defrost control in heating operation (Temp. measurement by outdoor heat exchanger and control for 4-way valve and outdoor fan)

3. Contents of operation command signal (Serial signal) from indoor unit controller to outdoor unit controller

The following three types of signals are sent from the indoor unit controller.

- Operation mode set on the remote controller
- Compressor revolution command signal defined by indoor temperature and set temperature (Correction along with variation of room temperature and correction of indoor heat exchanger temperature are added.)
- Temperature of indoor heat exchanger
- For these signals ([Operation mode] and [Compressor revolution] indoor heat exchanger temperature), the outdoor unit controller monitors the input current to the inverter, and performs the followed operation within the range that current does not exceed the allowable value.

4. Contents of operation command signal (Serial signal) from outdoor unit controller to indoor unit controller

The following signals are sent from the outdoor unit controller.

- The current operation mode
- The current compressor revolution
- Outdoor temperature
- Existence of protective circuit operation

  For transferring of these signals, the indoor unit controller monitors the contents of signals, and judges existence of trouble occurrence.

  Contents of judgment are described below.
  - Whether distinction of the current operation status meets to the operation command signal
  - Whether protective circuit operates

    When no signal is received from the outdoor unit controller, it is assumed as a trouble.

9-2. Operation Description

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9-3. Auto Restart Function

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9-4. Remote Controller and Its Fuctions

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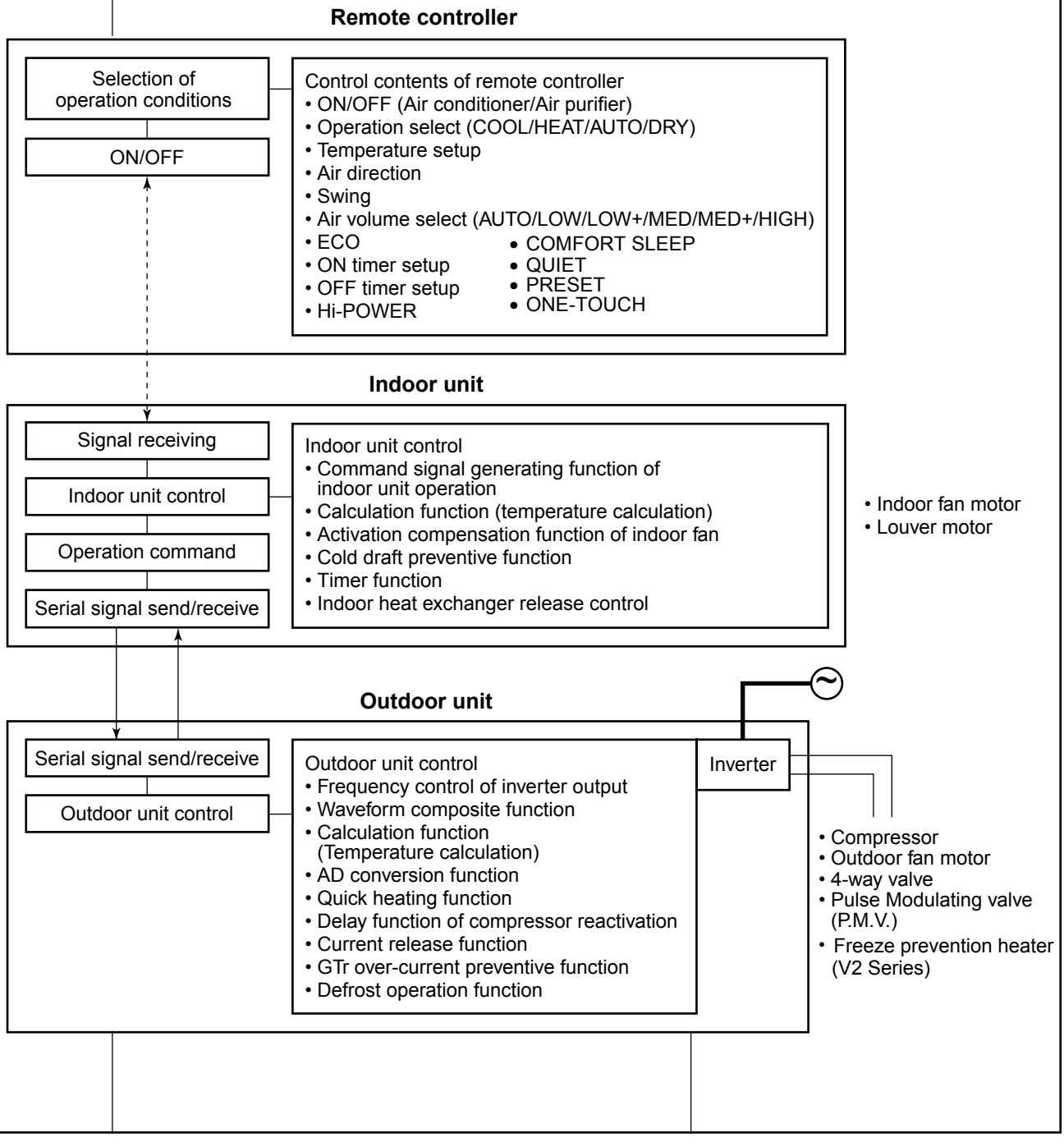
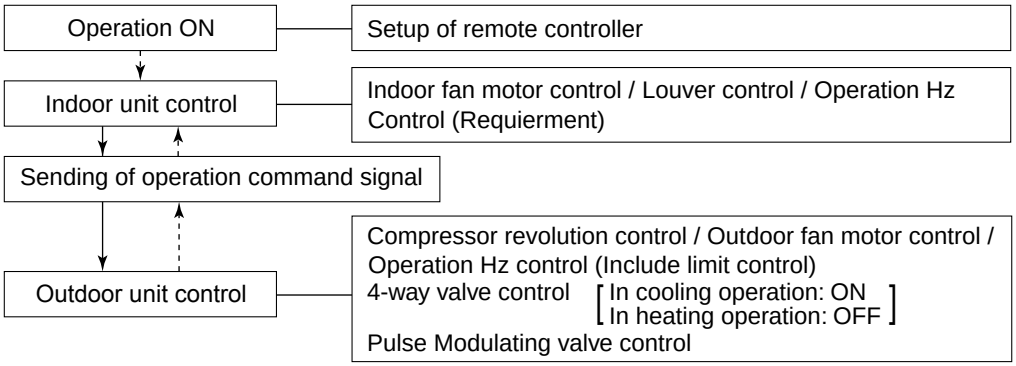
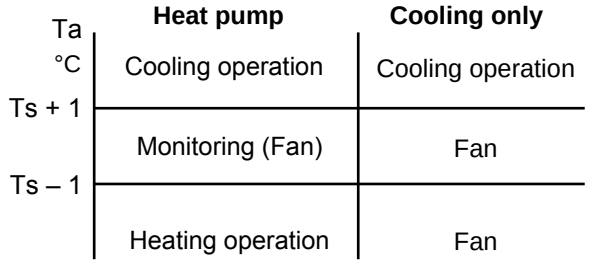
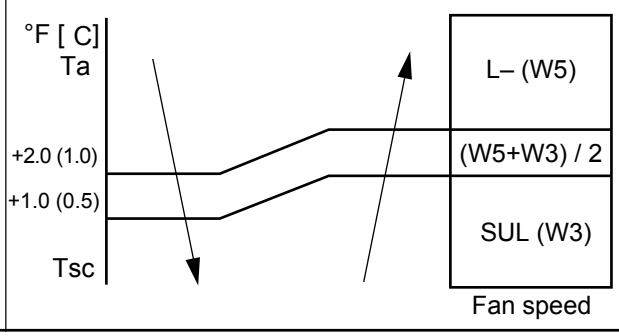
Item	Operation flow and applicable data, etc.	Description
1. Basic operation	1. Operation control	

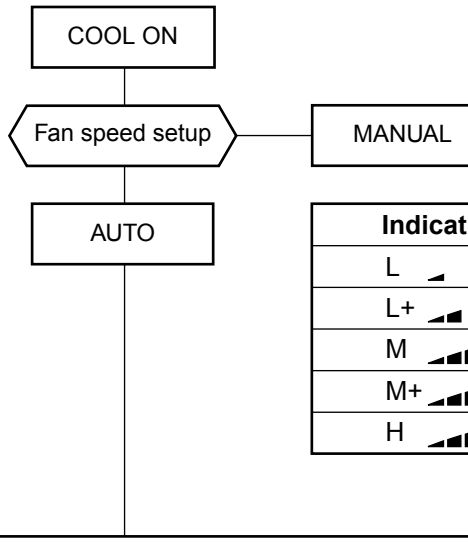
Receiving the user's operation condition setup, the operation statuses of indoor/outdoor units are controlled.

1) The operation conditions are selected by the remote controller as shown in the below.
2) A signal is sent by ON button of the remote controller.
3) The signal is received by a sensor of the indoor unit and processed by the indoor controllers as shown in the below.
4) The indoor controller controls the indoor fan motor and louver motor.
5) The indoor controller sends the operation command to the outdoor controller, and sends/receives the control status with a serial signal.
6) The outdoor controller controls the operation as shown in the left, and also controls the compressor, outdoor fan motor, 4-way valve and pulse Modulating valve.



Item	Operation flow and applicable data, etc.	Description
1. Basic operation	**2. Cooling/Heating operation** The operations are performed in the following parts by controls according to cooling/heating conditions. 1) Receiving the operation ON signal of the remote controller, the cooling or heating operation signal starts being transferred form the indoor controller to the outdoor unit. 2) At the indoor unit side, the indoor fan is operated according to the contents of "**2. Indoor fan motor control**" and the louver according to the contents of "**9. Louver control**", respectively. 3) The outdoor unit controls the outdoor fan motor, compressor, pulse Modulating valve and 4-way valve according to the operation signal sent from the indoor unit.  	
	3. AUTO operation Selection of operation mode As shown in the following figure, the operation starts by selecting automatically the status of room temperature (Ta) when starting AUTO operation. *1. When reselecting the operation mode, the fan speed is controlled by the previous operation mode.  	1) Detects the room temperature (Ta) when the operation started. 2) Selects an operation mode from Ta in the left figure. 3) Fan operation continues until an operation mode is selected. 4) When AUTO operation has started within 2 hours after heating operation stopped and if the room temperature is 68°F (20°C) or more, the fan operation is performed with "Super Ultra LOW" mode for 3 minutes. Then, select an operation mode. 5) In AUTO mode, either cooling or heating operation will be selected. When room temperature reach set temperature commpressor will stop. In case that the compressor stops for 15 minutes, the AUTO mode will reselect cooling or heating operation.
	4. DRY operation DRY operation is performed according to the difference between room temperature and the setup temperature as shown below. In DRY operation, fan speed is controlled in order to prevent lowering of the room temperature and to avoid air flow from blowing directly to persons.  	1) Detects the room temperature (Ta) when the DRY operation started. 2) Starts operation under conditions in the left figure according to the temperature difference between the room temperature and the setup temperature (Tsc). Setup temperature (Tsc) = Set temperature on remote controller (Ts) + 0~1.0°C (0 to 2°F) 3) When the room temperature is lower 2°F (1°C) or less than the setup temperature, turn off the compressor.

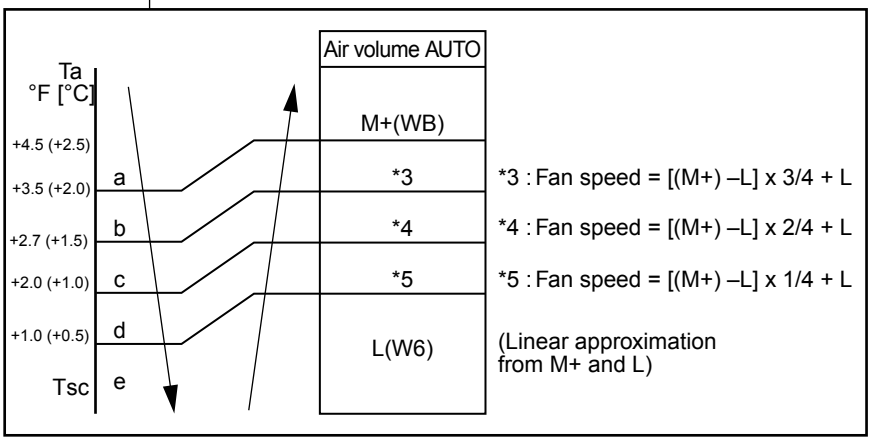
Item	Operation flow and applicable data, etc.	Description
2. Indoor fan motor control	**<In cooling operation>** (This operation controls the fan speed at indoor unit side.) The indoor fan (cross flow fan) is operated by the phase-control induction motor. The fan rotates in 5 stages in MANUAL mode, and in 5 stages in AUTO mode, respectively. (Table 1)	



(Fig. 1)

Indication	Fan speed
L	W6
L+	(L + M) / 2
M	W9
M+	(M + H) / 2
H	WC

(Fig. 2)



*** Symbols**

UH	: Ultra High
H	: High
M+	: Medium+
M	: Medium
L+	: Low+
L	: Low
L-	: Low–
UL	: Ultra Low
SUL	: Super Ultra Low

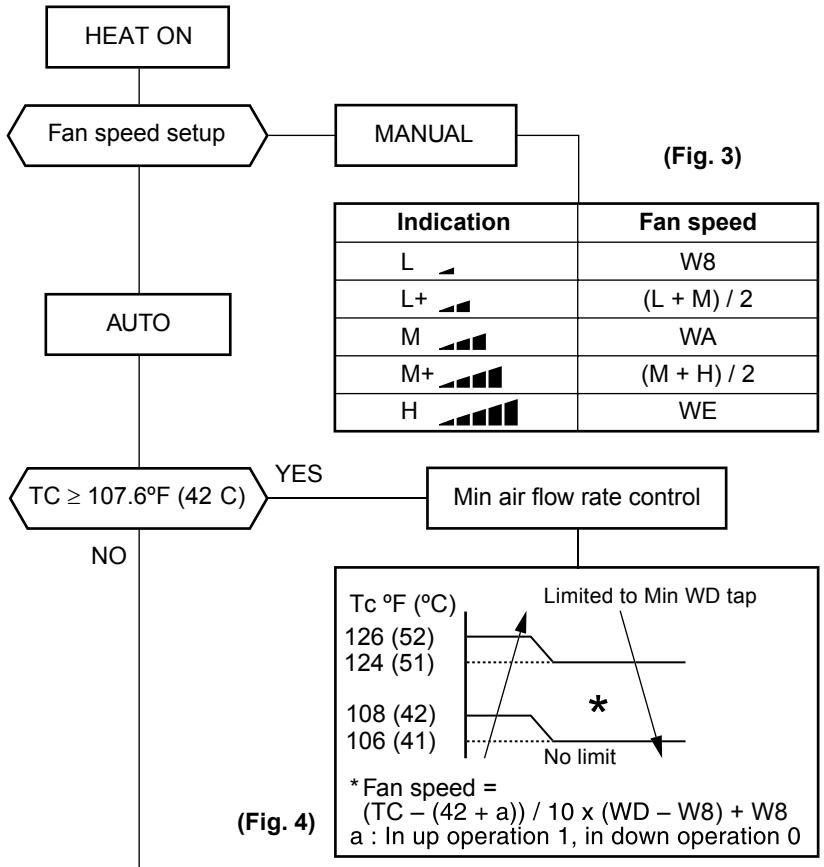
* The values of fan speed and air flow volume indicate on the table are measured when the louver is inclined downward. Fan speed and air flow volume broadly vary with position of louver.

1) When setting the fan speed to L, L+, M, M+ or H on the remote controller, the operation is performed with the constant speed shown in Fig. 1.
2) When setting the fan speed to AUTO on the remote controller, revolution of the fan motor is controlled to the fan speed level shown in Fig. 2 and Table 1 according to the setup temperature and room temperature.

(Table 1) Indoor fan air flow rate

Fan speed level	COOL	HEAT	DRY	RAS-09EKV-UL		RAS-12EKV-UL	
				Fan speed (rpm)	Air flow rate cfm (m3/h)	Fan speed (rpm)	Air flow rate cfm (m3/h)
WF		UH		1210	336 (571)	1510	433 (735)
WE		H		1210	336 (571)	1510	433 (735)
WD	UH	M+	UH	1170	321 (546)	1480	422 (717)
WC	H		H	1120	303 (515)	1430	404 (686)
WB	M+		M+	1040	274 (465)	1280	350 (594)
WA			M	1000	248 (421)	1220	328 (557)
W9	M	L+		960	235 (400)	1150	302 (514)
W8		L		870	200 (340)	1000	248 (421)
W7	L+	L-	L+	850	194 (330)	980	241 (409)
W6	L		L	760	159 (270)	920	219 (372)
W5	L-	UL	L-	760	159 (270)	900	212 (360)
W4	UL		UL	700	141 (240)	840	190 (323)
W3	SUL		SUL	650	118 (200)	770	165 (280)
W2		SUL		500	65 (110)	620	110 (187)
W1				500	65 (110)	520	74 (126)

Item	Operation flow and applicable data, etc.	Description
2. Indoor fan motor control	**<In heating operation>**	1) When setting the fan speed to L, L+, M, M+ or H on the remote controller, the operation is performed with the constant speed shown in Fig. 3 and Table 1. 2) When setting the fan speed to AUTO on the remote controller, revolution of the fan motor is controlled to the fan speed level shown in Fig. 5 according to the set temperature and room temperature. 3) Min air flow rate is controlled by temperature of the indoor heat exchanger (Tc) as shown in Fig. 4 for prevent high temperature of heat exchanger. 4) Cold draft prevention, the fan speed is controlled by temperature of the indoor heat exchanger (Tc) as shown in Fig. 6 for keep warm temperature of air flow. 5) In order to prevent Cold draft when compressor stop during heating operation. Then louver will move to upper position and fan speed will reduce or off.

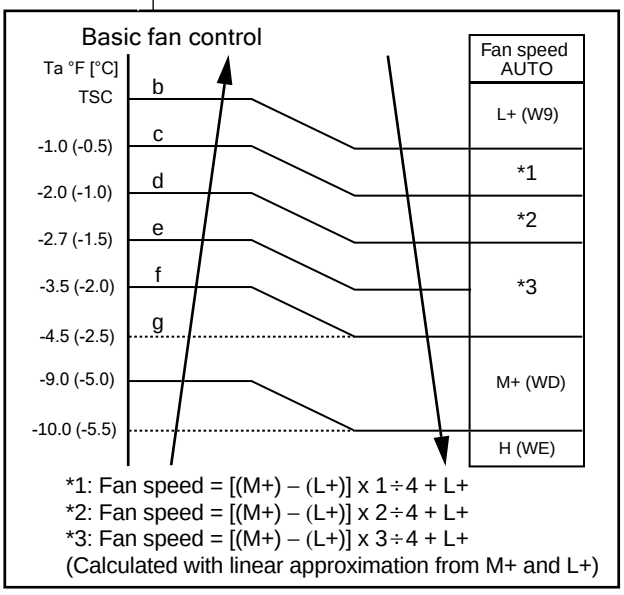


(Fig. 3)

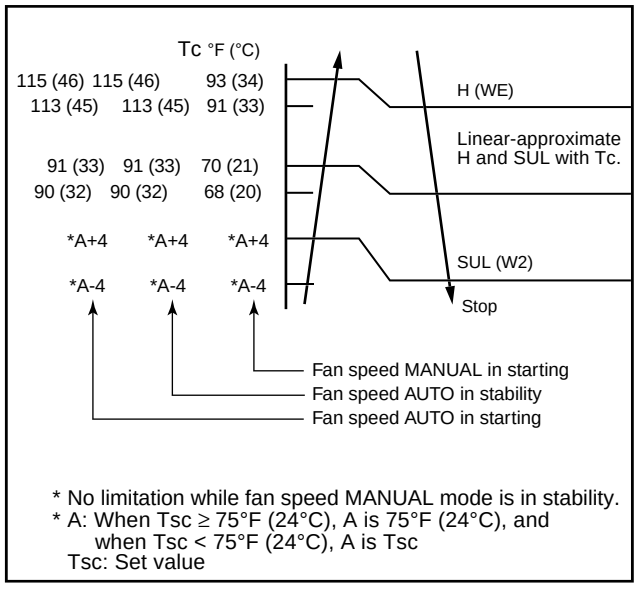
Indication	Fan speed
L	W8
L+	(L + M) / 2
M	WA
M+	(M + H) / 2
H	WE

(Fig. 4)

Cold draft preventive control



(Fig. 5)

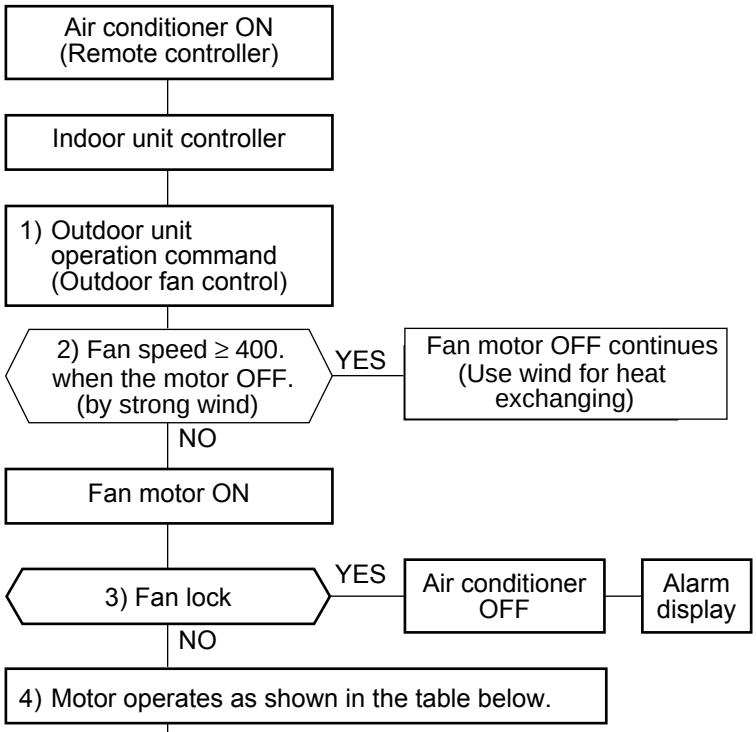

Tc °F (°C)
115 (46) 115 (46) 93 (34)
113 (45) 113 (45) 91 (33)
91 (33) 91 (33) 70 (21)
90 (32) 90 (32) 68 (20)
*A+4 *A+4 *A+4
*A-4 *A-4 *A-4
H (WE)
Linear-approximate H and SUL with Tc.
SUL (W2)
Stop
Fan speed MANUAL in starting
Fan speed AUTO in stability
Fan speed AUTO in starting
* No limitation while fan speed MANUAL mode is in stability.
* A: When Tsc ≥ 75°F (24°C), A is 75°F (24°C), and
when Tsc < 75°F (24°C), A is Tsc
Tsc: Set value

(Fig. 6)

[In starting and in stability]

	In starting	In stability
FAN AUTO	• Until 12 minutes passed after operation start • When 12 to 25 minutes passed after operation start and room temp. is 5.4°F (3°C) or lower than set temp.	• When 12 to 25 minutes passed after operation start and room temp. is higher than [set temp. -5.4ºF (–3°C)] • When 25 minutes or more passed after operation start
FAN Manual	• Room temp. < Set temp. -7°F (– 4°C)	• Room temp. ≥ Set temp. -6.3°F (–3.5°C)

Item	Operation flow and applicable data, etc.	Description
3. Outdoor fan motor control	The blowing air volume at the outdoor unit side is controlled. Receiving the operation command from the controller of indoor unit, the controller of outdoor unit controls fan speed. * For the fan motor, a DC motor with non-stage variable speed system is used. However, it is limited to 8 stages for reasons of controlling.	1) The operation command sent from the remote controller is processed by the indoor unit controller and transferred to the controller of the outdoor unit. 2) When strong wind blows at outdoor side, the operation of air conditioner continues with the fan motor stopped. 3) Whether the fan is locked or not is detected, and the operation of air conditioner stops and an alarm is displayed if the fan is locked. 4) According to each operation mode, by the conditions of outdoor temperature (To) and compressor revolution, the speed of the outdoor fan shown in the table is selected.


Air conditioner ON (Remote controller)
Indoor unit controller
1) Outdoor unit operation command (Outdoor fan control)
2) Fan speed ≥ 400. when the motor OFF. (by strong wind)
YES
Fan motor OFF continues (Use wind for heat exchanging)
NO
Fan motor ON
3) Fan lock
YES
Air conditioner OFF
Alarm display
NO
4) Motor operates as shown in the table below.

In cooling operation

Compressor speed (rps)		~ 13.8		~ 31.7		32.3 ~ MAX	
		MIN	MAX	MIN	MAX	MIN	MAX
To	To ≥ 100°F (38°C)	f 2	f 3	f C	f D	f E	f F
	To ≥ 82°F (28°C)	f 2	f 3	f A	f C	f D	f F
	To ≥ 59°F (15°C)	f 2	f 3	f 7	f A	f 9	f C
	To ≥ 42°F (5.5°C)	f 1	f 3	f 2	f 5	f 4	f 7
	To ≥ 32°F (0°C)	f 1	f 1	f 1	f 2	f 2	f 4
	To < 32°F (0°C)	f 0	f 0	f 0	f 1	f 1	f 2
During ECO mode	To ≥ 100°F (38°C)	f 2	f 3	f B	f C	f C	f D
	To ≥ 100°F (38°C)	f 2	f 3	f 2	f 3	f B	f C
When To is abnormal		f D	f F	f D	f F	f D	f F

In Heating operation

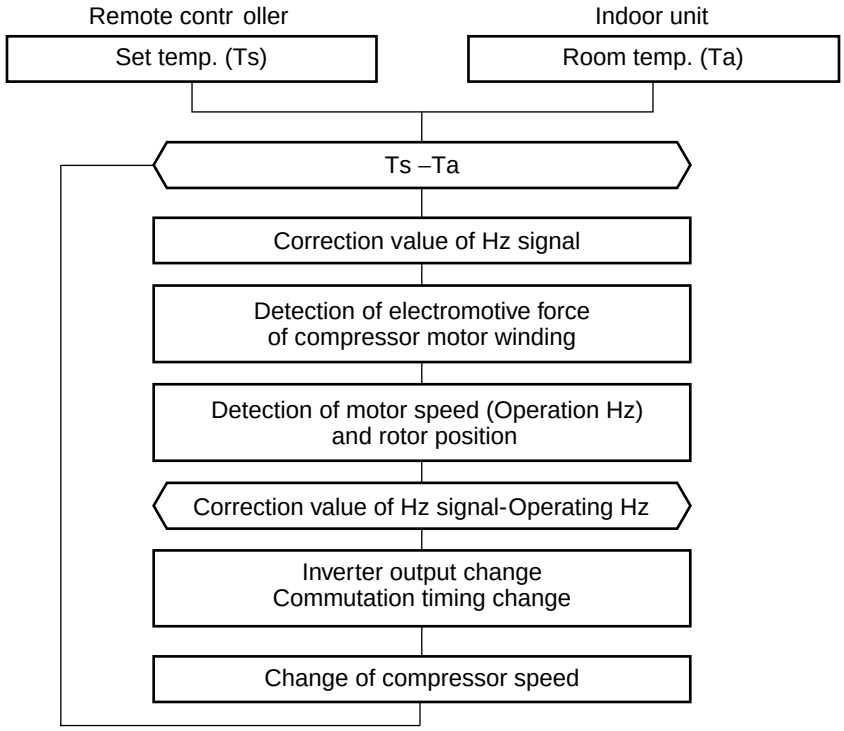
Compressor speed (rps)		~16.8	~47.9	48.5 ~ MAX
To	To ≥ 50°F (10°C)	f 3	f 8	f 9
	To ≥ 42°F (15°C)	f 3	f 9	f A
	To ≥ 22°F (-5°C)	f 8	f A	f D
	To < 22°F (-5°C)	f B	f C	f D
During ECO mode	To ≥ 50°F (10°C)	f 3	f 3	f 6
	To ≥ 42°F (15°C)	f 3	f 3	f 8
	To ≥ 22°F (-5°C)	f 5	f 9	f 9
	To < 22°F (-5°C)	f 7	f A	f B
When To is abnormal		f A	f B	f D

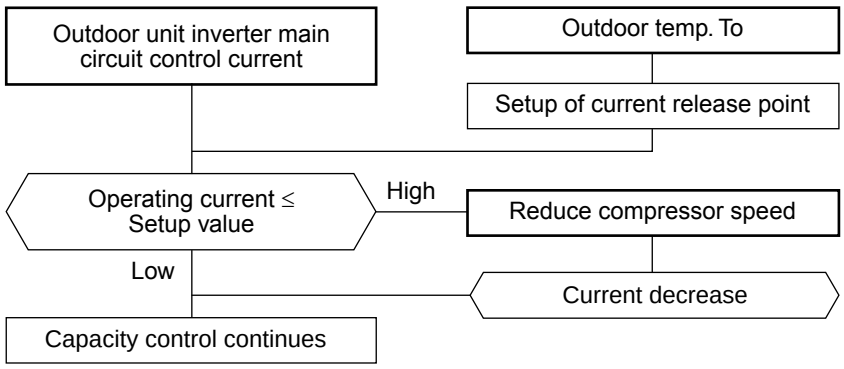
Outdoor fan speed (rpm)

Tap	RAS-09EA Series	RAS-12EA Series
f 0	0	0
f 1	200	200
f 2	300	300
f 3	370	370
f 4	440	440
f 5	440	440
f 6	500	500
f 7	550	550

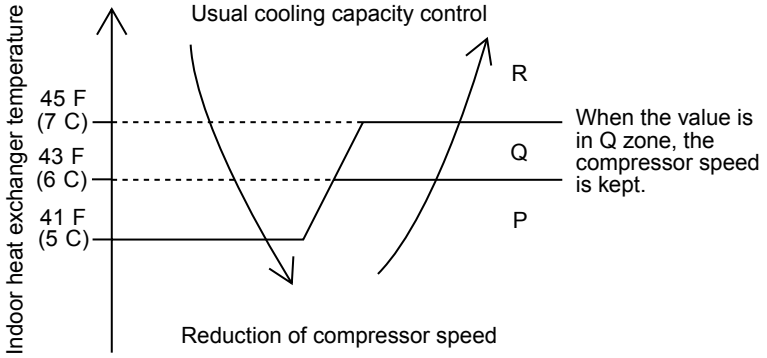
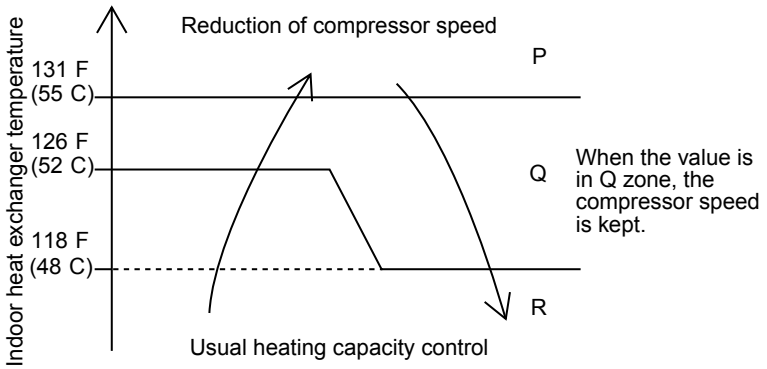
Tap	RAS-09EA Series	RAS-12EA Series
f 8	600	600
f 9	600	650
f A	600	700
f B	650	700
f C	700	800
f D	700	800
f E	700	800
f F	700	900

Item	Operation flow and applicable data, etc.	Description
4. Capacity control	The cooling or heating capacity depending on the load is adjusted. According to difference between the setup value of temperature and the room temperature, the capacity is adjusted by the compressor revolution.	1) The difference between set temperature on remote controller (Ts) and room temperature (Ta) is calculated. 2) According to the temperature difference, the correction value of Hz signal which determines the compressor speed is set up. 3) The rotating position and speed of the motor are detected by the electromotive force occurred on the motor winding with operation of the compressor. 4) According to the difference resulted from comparison of the correction value of Hz signal with the present operation Hz, the inverter output and the commutation timing are varied. 5) Change the compressor motor speed by outputting power to the compressor. * The contents of control operation are same in cooling operation and heating operation
5. Current release control	This function prevents troubles on the electronic parts of the compressor driving inverter. This function also controls drive circuit of the compressor speed so that electric power of the compressor drive circuit does not exceed the specified value.	1) The input current of the outdoor unit is detected in the inverter section of the outdoor unit. 2) According to the detected outdoor temperature, the specified value of the current is selected. 3) Whether the current value exceeds the specified value or not is judged. 4) If the current value exceeds the specified value, this function reduces the compressor speed and controls speed up to the closest one commanded from the indoor unit within the range which does not exceed the specified value.

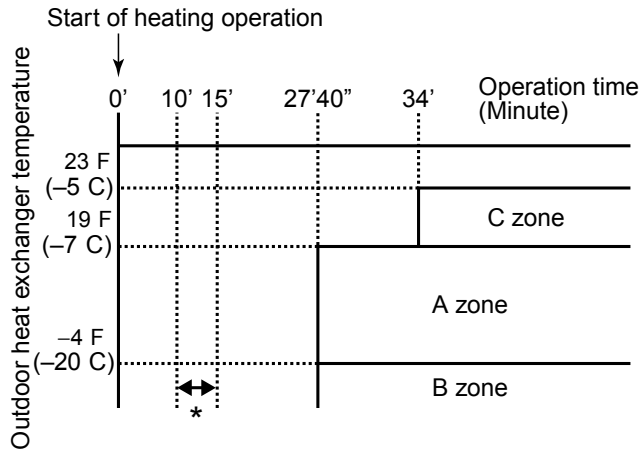

Remote contr oller
Indoor unit
Set temp. (Ts)
Room temp. (Ta)
Ts –Ta
Correction value of Hz signal
Detection of electromotive force of compressor motor winding
Detection of motor speed (Operation Hz) and rotor position
Correction value of Hz signal-Operating Hz
Inverter output change Commutation timing change
Change of compressor speed



Outdoor temp.	Cooling current release value		Heating current release value	
	RAS-09EA Series	RAS-12EA Series	RAS-09EA Series	RAS-12EA Series
113ºF (45ºC)	3.97A	4.27A	6.30A	7.72A
104ºF (40ºC) 111ºF (44ºC)	4.35A	4.88A		
61ºF (16ºC) 102ºF (39ºC)	6.30A	8.47A		
52ºF (11ºC) 60ºF (15.5ºC)				
51ºF (10.5ºC)			6.30A	8.10A
			6.30A	8.47A

Item	Operation flow and applicable data, etc.	Description
6. Release protective control by temperature of indoor heat exchanger	**<In cooling/dry operation>** (Prevent-freezing control for indoor heat exchanger) In cooling/dry operation, the sensor of indoor heat exchanger detects evaporation temperature and controls the compressor speed so that temperature of the heat exchanger does not exceed the specified value.  	1) When temperature of the indoor heat exchanger drops below 41°F (5°C), the compressor speed is reduced. (P zone) 2) When temperature of the indoor heat exchanger rises in the range from 43°F (6°C) to under 45°F (7°C), the compressor speed is kept. (Q zone) 3) When temperature of the indoor heat exchanger rises to 45°F (7°C) or higher, the capacity control operation returns to the usual control in cooling operation. (R zone)
	<In heating operation> (Prevent-overpressure control for refrigerating cycle) In heating operation, the sensor of indoor heat exchanger detects condensation temperature and controls the compressor speed so that temperature of the heat exchanger does not exceed the specified value.  	1) When temperature of the indoor heat exchanger rises in the range from 126°F (52°C) to 131°F (55°C), compressor speed is kept. (Q zone) When temperature of the indoor heat exchanger drops in the range from 118°F (48°C) to under 131°F (55°C) the compressor speed is kept. (Q zone) 2) When temperature of the indoor heat exchanger rises to 131°F (55°C) or higher, the compressor speed is reduced. (P zone) 3) When temperature of the indoor heat exchanger does not rise to 126°F (52°C), or when it drops below to 118°F (48°C), the capacity control operation returns to the usual control in heating operation. (R zone)

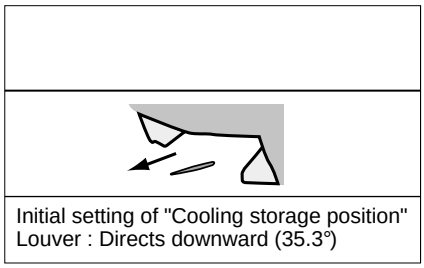
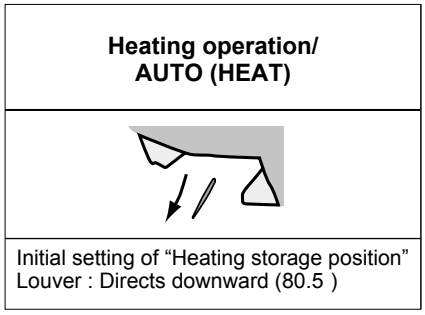
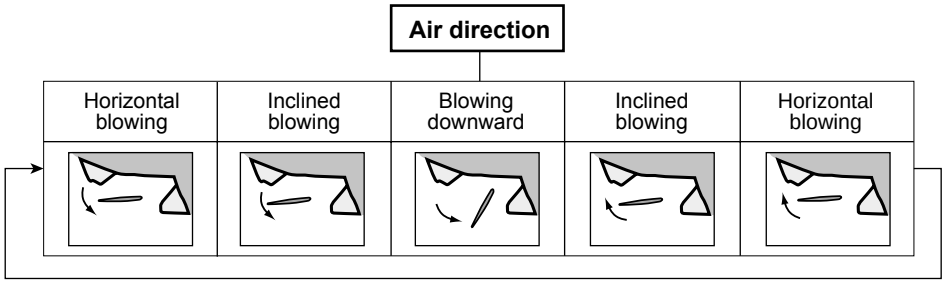
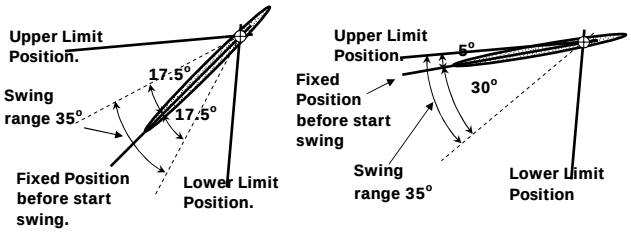
Item	Operation flow and applicable data, etc.	Description
7. Defrost control (Only in heating operation)	(This function removes frost adhered to the outdoor heat exchanger.) The temperature sensor of the outdoor heat exchanger (Te sensor) judges the frosting status of the outdoor heat exchanger and the defrost operation is performed with 4-way valve reverse defrost system.	The necessity of defrost operation is detected by the outdoor heat exchanger temperature. The conditions to detect the necessity of defrost operation differ in A, B, or C zone each. (Table 1) **<Defrost operation>** • Defrost operation in A to C zones 1) Stop operation of the compressor for 20 seconds. 2) Invert (ON) 4-way valve 10 seconds after stop of the compressor. 3) The outdoor fan stops at the same time when the compressor stops. 4) When temperature of the indoor heat exchanger becomes 100°F (38°C) or lower, stop the indoor fan. **<Finish of defrost operation>** • Returning conditions from defrost operation to heating operation 1) Temperature of outdoor heat exchanger rises to 46°F (8°C) or higher. 2) Temperature of outdoor heat exchanger is kept at 41°F (5°C) or higher for 80 seconds. 3) Defrost operation continues for 15 minutes. **<Returning from defrost operation>** 1) Stop operation of the compressor for approx. 50 seconds. 2) Invert (OFF) 4-way valve approx. 40 seconds after stop of the compressor. 3) The outdoor fan starts rotating at the same time when the compressor starts.



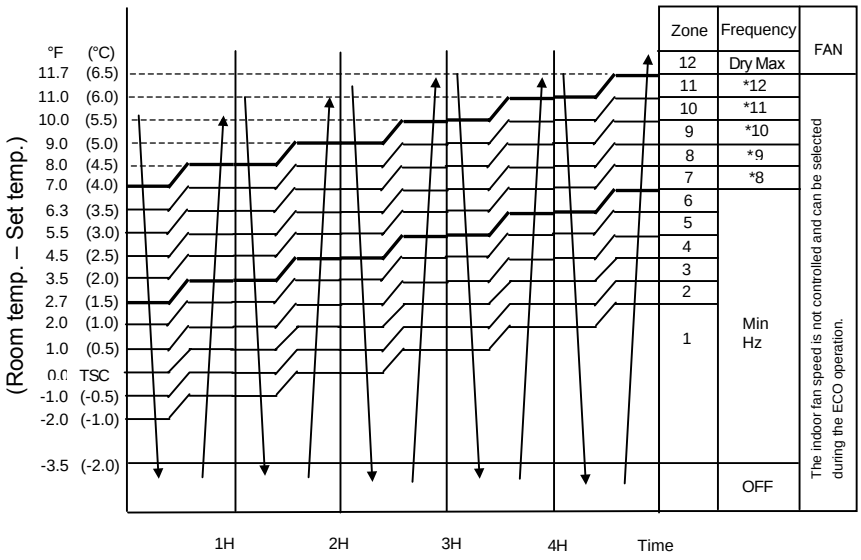
* The minimum value of Te sensor 10 to 15 minutes after start of operation is stored in memory as Te0.

Table 1

A zone	When Te0 - TE ≥ 4.5°F (2.5°C) continued for 2 minutes in A zone, defrost operation starts.
B zone	When the operation continued for 2 minutes in B zone, defrost operation starts.
C zone	When Te0 - TE ≥ 5.4°F (3°C) continued for 2 minutes in C zone, defrost operation starts.

Item	Operation flow and applicable data, etc.	Description
8. Louver control 1) Louver position	This function controls the air direction of the indoor unit. • The position is automatically controlled according to the operation mode (COOL/HEAT). • The set louver position is stored in memory by the microcomputer, and the louver returns to the stored position when the next operation is performed. (Cooling/Heating memory position) The angle of the louver is indicated as the louver closes fully is 0°. 1) Louver position in cooling operation  Initial setting of "Cooling storage position" Louver : Directs downward (35.3°) **2) Louver position in heating operation**  **Heating operation/ AUTO (HEAT)** Initial setting of "Heating storage position" Louver : Directs downward (80.5)	
2) Air direction adjustment	 **Air direction** Horizontal blowing / Inclined blowing / Blowing downward / Inclined blowing / Horizontal blowing	• The louver position can be arbitrarily set up by pressing [FIX] button.
3) Swing	• Swing operation is perfor in range 35° with the Fixed position as the center. • If the swing range exceeded either upper or lower limit position, swing operation is perfomed in range 35° from the limit.  Upper Limit Position. / 17.5° / Swing range 35° / 17.5° / Fixed Position before start swing. / Lower Limit Position. Upper Limit Position. / 5° / Fixed Position before start swing / 30° / Swing range 35° / Lower Limit Position	• Swing When pressing [SWING] button during operation, the louver starts swinging.

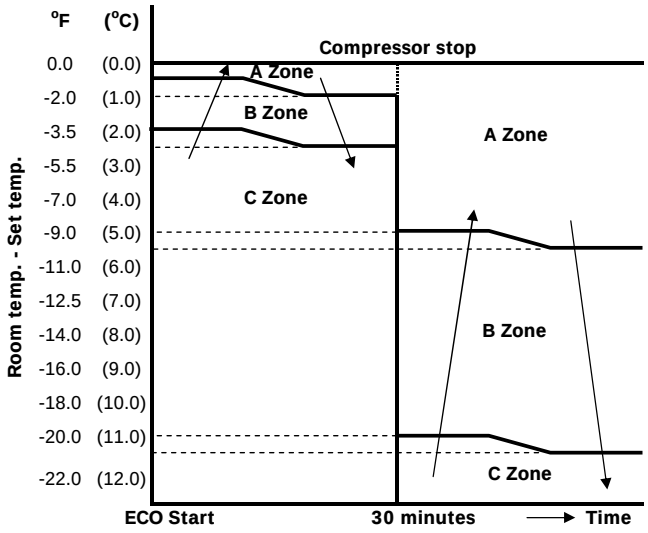
Item	Operation flow and applicable data, etc.	Description
9. ECO operation	When pressing [ECO] button on the remote controller, a Economic operation is performed. **<Cooling operation>** This function operates the air conditioner with the difference between the set and the room temperature as shown in the following figure.	**<Cooling operation>** 1) The control target temperature increase 1.0°F (0.5ºC) per hour up to 3.5°F (2°C) starting from the set temperature when ECONO has been received. 2) The indoor fan speed is depend on presetting and can change every speed after setting ECO operation. 3) The compressor speed is controlled as shown in the left figure.



* 12 (DRY max - COOL min) /6 x 5 + COOL min
* 11 (DRY max - COOL min) /6 x 4 + COOL min
* 10 (DRY max - COOL min) /6 x 3 + COOL min
* 9 (DRY max - COOL min) /6 x 2 + COOL min
* 8 (DRY max - COOL min) /6 x 1 + COOL min

Hz	09EKV-UL	12EKV-UL
Cool min	20	11
DRY max	35	31

< Heating Operation >



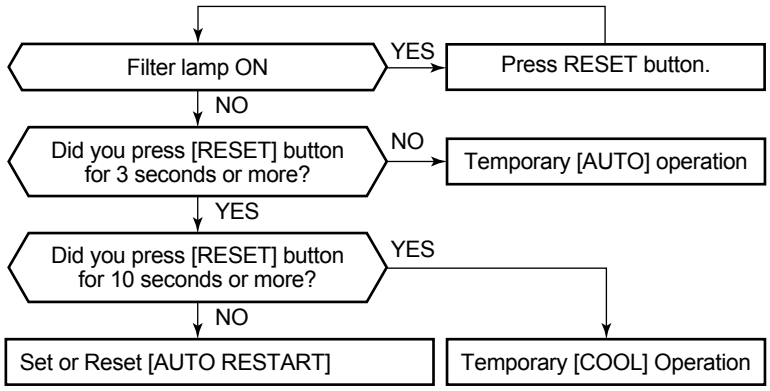
Compressor speed (Hz)

Zone	Model	
	09EKV-UL	12EKV-UL
A	20	13
B	Linear aproximation between A to C	
C	50	43

<Heating operation>

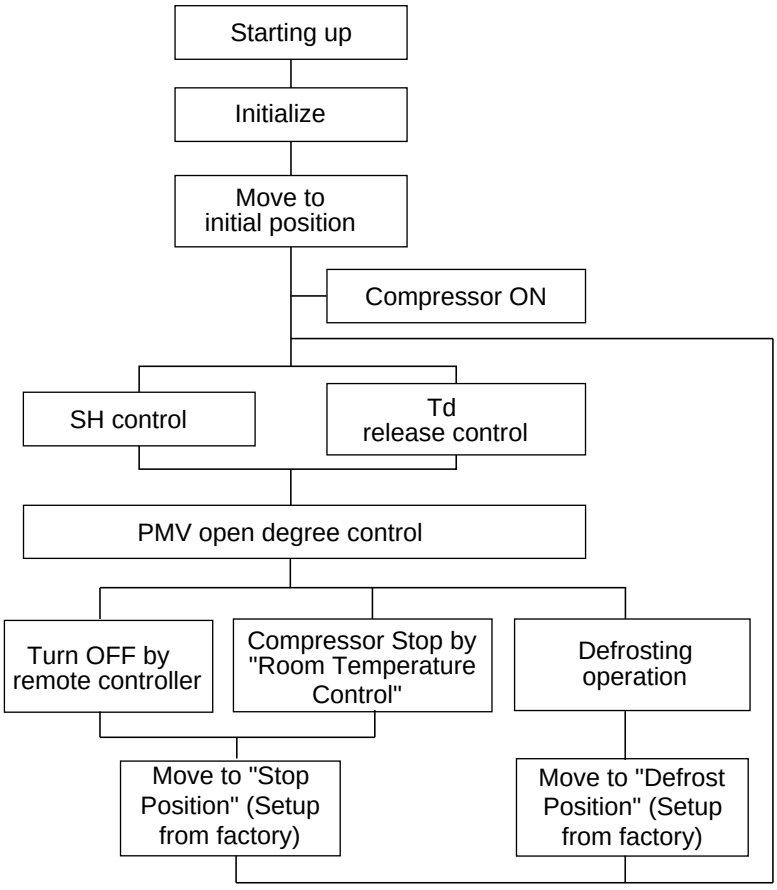
1) The difference of room temperature and set temperature are separated in to A zone, B zone and C zone.
   Three zone will changed again 30 minutes after ECO operation start.
2) The compressor speed is controlled as shown on the table.
3) The indoor fan speed is not controlled and can be selected during the ECO operation.

Item	Operation flow and applicable data, etc.	Description
10. Temporary operation	Pressing [RESET] button starts the temporary operation of [AUTO] operation. When keeping [RESET] button pressed for 10 seconds or more, the temporary [COOL] operation is performed.	1) When pressing [RESET] button, the temporary [AUTO] operation starts. 2) When keeping [RESET] button pressed for 3 seconds or more, Pi, Pi, Pi sound is heard and [AUTO RESTART] control is changed. 3) When keeping [RESET] button pressed for 10 seconds or more, “Pi” sound is heard and the temporary [COOL] operation starts. 4) If the filter lamp goes on, press [RESET] button to go off the filter lamp, and then press [RESET] button again. 5) To stop the temporary operation, press the button again.
11. Discharge temperature control		**1. Purpose** This function detects error on the refrigerating cycle or error on the compressor, and performs protective control. **2. Operation** • Control of the compressor speed The speed control is performed as described in the left table based upon the discharge temperature.



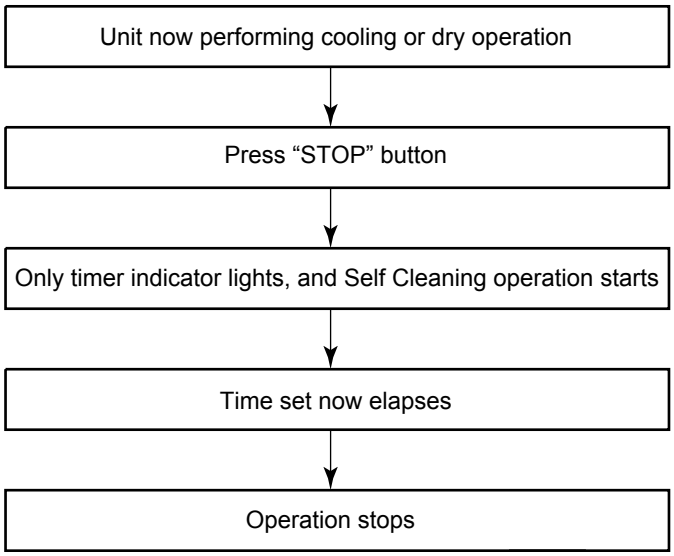
Td value	Control operation
243°F (117°C)	Judges as an error and stops the compressor.
233°F (112°C)	Reduce the compressor speed.
226°F (108°C)	Reduce slowly compressor speed.
221°F (105°C)	Keeps the compressor speed.
208°F (98°C)	If the operation is performed with lower speed than one commanded by the serial signal, speed is slowly raised up to the commanded speed.
	Operates with speed commanded by the serial signal.

Item	Operation flow and applicable data, etc.	Description
12. Pulse Modulating valve (P.M.V.) control	This function controls throttle amount of the refrigerant in the refrigerating cycle. According to operating status of the air conditioner, this function also controls the open degree of valve with an expansion valve with pulse Modulation.	1) When starting the operation, move the valve once until it fits to the stopper. (Initialize) * In this time, “Click” sound may be heard. 2) Adjust the open degree of valve by super heat amount. (SH control) 3) If the discharge temperature was excessively up, adjust the open degree of valve so that it is in the range of set temperature. (Discharge temp. control) 4) When defrost operation is performed, the open degree of valve is adjusted according to each setup conditions during preparation for defrost and during defrost operation (4-way valve is inversed.). 5) When operation is OFF by the remote controller or when compressor is OFF by room temperature control, the open degree of valve is adjusted to the stop position.



* SH (Super Heat amount) =
  Ts (Temperature of suction pipe of the compressor) –
  Tc or Te (Heat exchanger temperature at evaporation side)
* PMV: Pulse Modulating Valve

Item	Operation flow and applicable data, etc.	Description
13. Self-Cleaning function		**1. Purpose** The Self-Cleaning operation is to minimize the growth of mold, bacteria etc. by running the fan and drying so as to keep the inside of the air conditioner clean. **Self-Cleaning operation** When the cooling or dry operation shuts down, the unit automatically starts the Self-Cleaning operation which is then performed for the specified period based on duration of the operation which was performed prior to the shutdown, after which the Self-Cleaning operation stops. (The Self-Cleaning operation is not performed after a heating operation.) **2. Operation** 1) When the stop signal from the remote controller or timer-off function is received, only the timer indicator light. 2) The period of the Self-Cleaning operation is determined by the duration of the operation performed prior to the reception of the stop code. 3) After the Self-Cleaning operation has been performed for the specified period, the unit stops operating.


Unit now performing cooling or dry operation
Press “STOP” button
Only timer indicator lights, and Self Cleaning operation starts
Time set now elapses
Operation stops

- During Self-Cleaning operations: The louver opens slightly. The indoor fan operates continuously at a speed of 500 rpm.

Self-Cleaning operation times

	Operation time	Self-Cleaning operation time
Cooling: Auto (cooling) Dry	Up to 10 minutes	No Self-Cleaning operation performed (0 minutes)
	10 minutes or longer	30 mins.
Heating: Auto (heating)	No Self-Cleaning operation performed	
Auto (fan only)		
Shutdown		

- To stop an ongoing Self-Cleaning operation at any time
  Press the start/stop button on the remote controller twice during the Self-Cleaning operation. (After pressing the button for the first time, press it for the second time without delay (within 10 minutes).)

Item	Operation flow and applicable data, etc.	Description
13. Self-Cleaning function	• Self-Cleaning diagram	

Operation display	ON	OFF	OFF
FCU fan	ON rpm is depend on presetting.	ON (500RPM)	OFF
FCU louver	OPEN	OPEN (12.7º)	CLOSE
Timer display	ON or OFF depend on presetting of timer function.	ON	ON or OFF depend on presetting of timer function.
Compressor	ON or OFF depend on presetting per room temperature.	OFF	OFF
CDU fan	ON or OFF depend on presetting per room temperature.	OFF	OFF

Operation time

Cool mode or dry mode operation more than 10 mins.

Self-Cleaning mode operate 30 mins.

Turn off by remote controller or timer-off function.

Automatically turn-off.

How to Set or Cancel Self-Cleaning operation.
(Default setting from factory is ON)

1. Connect jumper lead at J201 of the indoor P.C. board assembly.

2. To cancel Self-Cleaning operation.

Turn the power supply ON

↓

Press the [RESET] button located on the front panel of the indoor unit for more than 3 seconds.

↓

After 3 seconds, the unit beeps three times.
The Self-Cleaning is cancelled.

3. To set Self-Cleaning operation.

Turn the power supply ON

↓

Press the [RESET] button located on the front panel of the indoor unit for more than 3 seconds.

↓

After 3 seconds, the unit beeps three times and the **indicator blinks for 5 seconds**.
The Self-Cleaning is set.

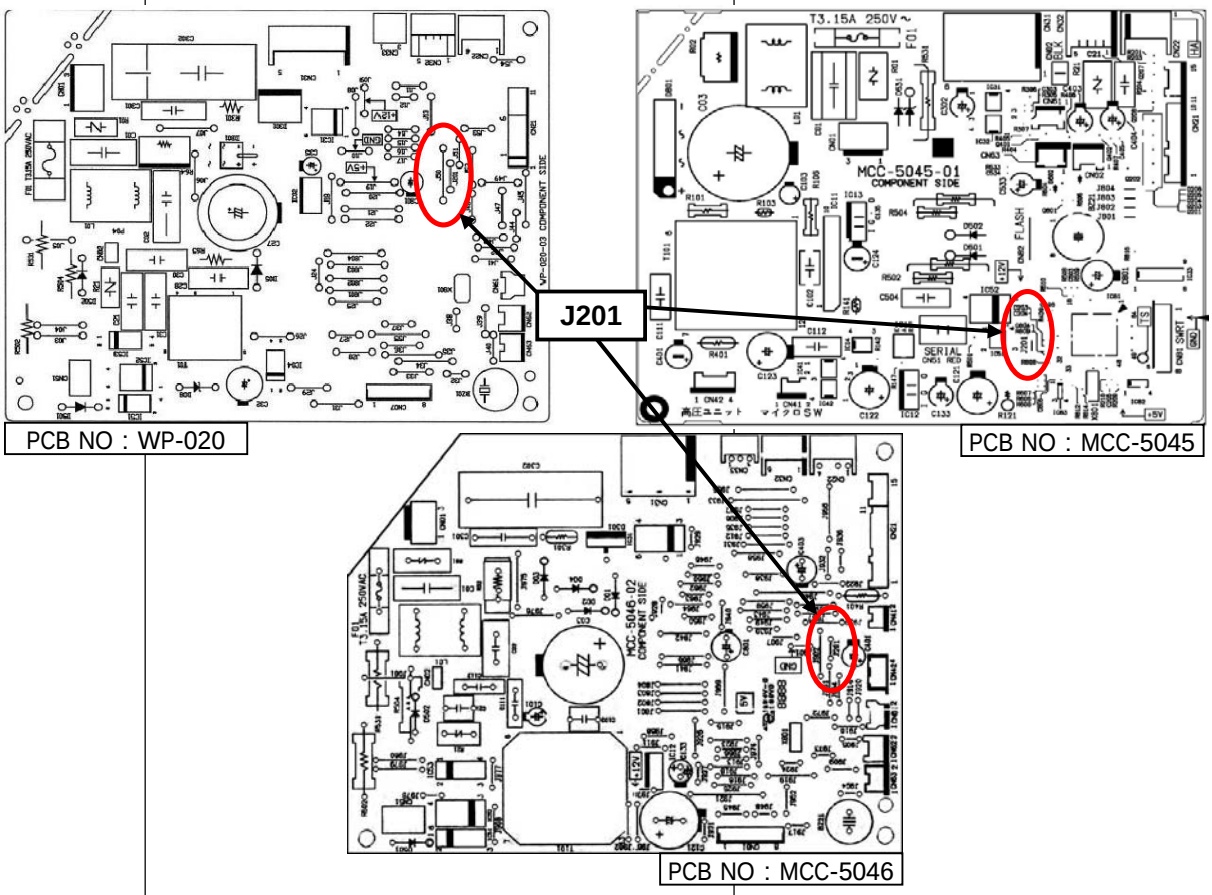
One J201 is added, it will effect as following.

- The operation when press the RESET button for 3 seconds will be changed from Set/Cancel the AUTO-RESTART to Set/Cancel the Self-Cleaning.
- AUTO-RESTART function will not activate. In case of AUTO-RESTART is need, disconnect the jumper J201 and set it again after Set/Cancel the Self-Cleaning finished.

Note :

J201 is near the MCU, so so take steps to ensure that it will not be exposed to excessive of heat.
Also take care to avoid solder bridging with the surrounding components.

Item	Operation flow and applicable data, etc.	Description



14. Remote-A or B selection

Setting the remote controller

To separate using of remote control for each indoor unit in case of 2 air conditioner are installed nearly.

Remote Control B Setup.

1) Press RESET button on the indoor unit to turn the air conditioner ON.
2) Point the remote control at the indoor unit.
3) Push and hold CHK • button on the Remote Control by the tip of the pencil. "00" will be shown shown on the display.
4) Press MODE • during pushing CHK •. "B" will show on the display and "00" will disappear and the air conditioner will turn OFF. The Remote Control B is memorized.

Note : 1. Repeat above step to reset Remote Control to be A.
2. Remote Control A has not "A" display.
3. Default setting of Remote Control from factory is A.

1. Purpose

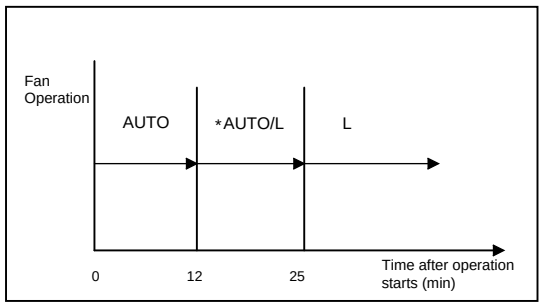
This operation is to operate only one indoor unit using one remote controller.

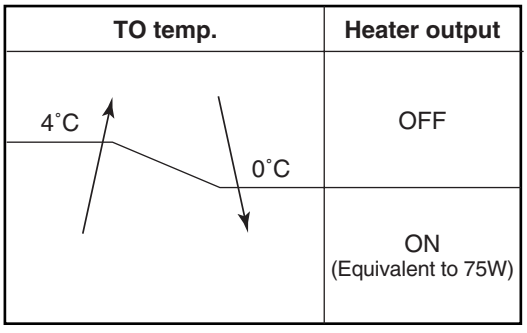
2. Description

When operating one indoor unit in a situation where two indoor units have been installed in the same room or nearby rooms, this operation prevents the remote controller signal from being received simultaneously by both units, thus preventing both units from operating.

3. Operation

The indoor unit on which the remote controller selection has been set to B receives the signal of the remote controller also set to B.
(At the factory the remote controller selection is set to A on all the indoor units. There is no A setting display.)

Item	Operation flow and applicable data, etc.	Description
15. QUIET mode	When the [QUIET] button is pressed, the fan of the indoor unit will be restricted the revolving speed at speed L－ until the [QUIET] button is pressed once again (cancel Quiet mode).	Quiet mode is the system which, control the revolving speed of indoor fan to work constantly at lower than speed L. In addition, noise level of indoor unit is less than usual. Remarks : 1. Quiet mode is unable to work in dry mode. 2. Quiet mode is appropriate to work with less cooling load and less heating load condition. Because of the fan speed L- may cause not enough the cooling capacity or heating capacity.
16. COMFORT SLEEP	**Cooling mode** • The preset temperature will increase as show on ECO operation (Item No. 9) • Press the [COMFORT SLEEP] button to choose the operating hours. Repeat pressing to select the hours. (1hr, 3hr, 5hr or 9hr) • If the [COMFORT SLEEP] button is pressed again means cancel comfort sleep mode. **Heating mode** • The preset temperature will drop down as show on ECO operation (Item No. 9) • Press the [COMFORT SLEEP] button to choose the operating hours. Repeat pressing to setect thehours. (1hr, 3hr, 5hr or 9 hr) • If the [COMFORT SLEEP] button is pressed again means cancel comfort sleep mode.	The principles of comfort sleep mode are: • Quietness for more comfortable. When room temperature reach setting temperature • Save energy by changing room temperature automatically. • The air condition can shut down by itself automatically. Remarks: Comfort sleep mode will not operate in dry mode and fan only mode.
17. One-Touch Comfort	One touch comfort is the fully automated operation that is set according to the preferable condition in a region.  *AUTO/L: Fan operates depends on the setting temperature and room temperature. During the One Touch Comfort mode if the indoor unit receives any signal with other operation mode, the unit will cancel the comfort mode and operates according to the signal received.	**Operation condition for model to Europe market** When an indoor unit receives "One Touch Comfort Signal" from the remote controller, the indoor unit operates as following. 1) Air conditioner starts to operation when the signal is received, even if the air conditioner was OFF. 2) Operation mode is set according to room temperature, the same as AUTO mode. 3) Target temperature is 75°F (24ºC). 4) Louver position is set as stored position of the operating mode. 5) Fan is controlled as followings.

Item	Operation flow and applicable data, etc.	Description
18. Hi-POWER Mode	**([Hi-POWER] button on the remote controller is pressed)** When [Hi-POWER] button is pressed while the indoor unit is in Auto, Cooling or Heating operation, Hi-POWER mark is indicated on the display of the remote controller and the unit operates as follows. **1. Automatic operation** • The indoor unit operates in according to the current operation. **2. Cooling operation** • The preset temperature drops 2.0°F (1ºC) (The value of the preset temperature on the remote controller does not change.) The indoor unit's fan speed level increase 1 tap **3. Heating operation** • The preset temperature increases 3.5°F (2ºC) (The value of the preset temperature on the remote controller does not change.) The indoor unit's fan speed level increase 1 tap **4. The Hi-POWER mode can not be set in Dry operation**	∗ The Hi-POWER operation will be cancelled when press [Hi-POWER] button again.
19. FILTER Indicator	When the elapsed time reaches 1000 hours after conditioner operation, the FILTER indicator lights. After cleaning the filters, turn off the FILTER indicator. **How to Turn Off FILTER Indicator** Press [RESET] button on the indoor unit. **NOTE :** If [RESET] button is pushed while the FILTER indicator is not lit, the indoor unit will start the automatic operation.	
20. Cord heater control (V2 Series only)	**<Base plate cord heater control>**  When TO sensor is defective, turn off normal heater output. When COOL thermostat is ON, turn off the heater output.	**1. Purpose** Base plate freeze prevention of the outdoor unit **2. Operation** As shown in the left figure, the base plate freeze preventive heater is controlled by temperature of the outside temp. sensor (TO).

9-3. Auto Restart Function (Default setting from factory is ON).

This indoor unit is equipped with an automatic restarting function which allows the unit to restart operating with the set operating conditions in the event of a power supply being accidentally shut down.
The operation will resume without warning three minutes after power is restored.

This function is set to work from the factory.

The Auto Restart Function will not restart operation of the air conditioner in following case.

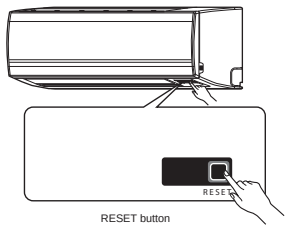
- The Auto Restart Function is setup to OFF.
- The power supply is shut down during the air conditioner is OFF.
- The power supply is shut down when timer operatio is set.

9-3-1. How to Cancel the Auto Restart Function

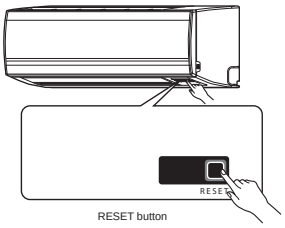
To cancel Auto Restart Function, proceed as follows.

1. The power supply to the unit must be ON ; The function will not set or reset if the power supply is OFF.
2. Press the [RESET] button located on the front panel of the indoor unit for more than 3 seconds.
3. After 3 seconds, the unit beeps three times.

• When the system is on stand-by (not operating)

Operation	Motions
Press [RESET] button for more than three seconds. (Less than 10 seconds)  RESET button	The unit is on standby. ↓ The unit starts to operate. The green indicator is on. ↓ After approx. three seconds, The unit beeps three times and continues to operate. If the unit is not required to operate at this time, press [RESET] button once more or use the remote controller to turn it off.

• When the system is operating

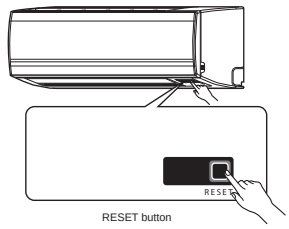
Operation	Motions
Press [RESET] button for more than three seconds. (Less than 10 seconds)  RESET button	The unit is in operation. The green indicator is on. ↓ The unit stops operating. The green indicator is turned off. ↓ After approx. three seconds, The unit beeps three times. If the unit is required to operate at this time, press [RESET] button once more or use the remote controller to turn it on.

9-3-2. How to Set the Auto Restart Function

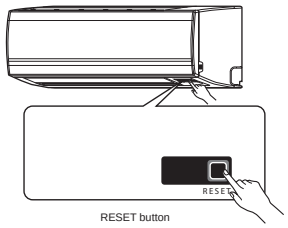
To set Auto Restart Function, proceed as follows:

1. The power supply to the unit must be ON ; The function will not set or reset if the power supply is OFF.
2. Press the [RESET] button located on the front panel of the indoor unit for more than 3 seconds.
3. After 3 seconds, the unit beeps three times and the indicator blinks for 5 seconds.

• When the unit is standby (Not operating)

Operation	Motions
Press [RESET] button for more than three seconds. (Less than 10 seconds)  RESET button	The unit is on standby. ↓ The unit starts to operate. The green indicator is on. ↓ After approx. three seconds, The unit beeps three times and continues to operate. **The green indicator flashes for 5 seconds.** If the unit is not required to operate at this time, press [RESET] button once more or use the remote controller to turn it off.

• When the unit is in operation

Operation	Motions
Press [RESET] button for more than three seconds. (Less than 10 seconds)  RESET button	The unit is in operation. The green indicator is on. ↓ The unit stops operating. The green indicator is turned off. ↓ After approx. three seconds, The unit beeps three times. **The green indicator flashes for 5 seconds.** If the unit is required to operate at this time, press [RESET] button once more or use the remote controller to turn it on.

• While the filter check indicator is on, the RESET button has the function of filter reset betton.

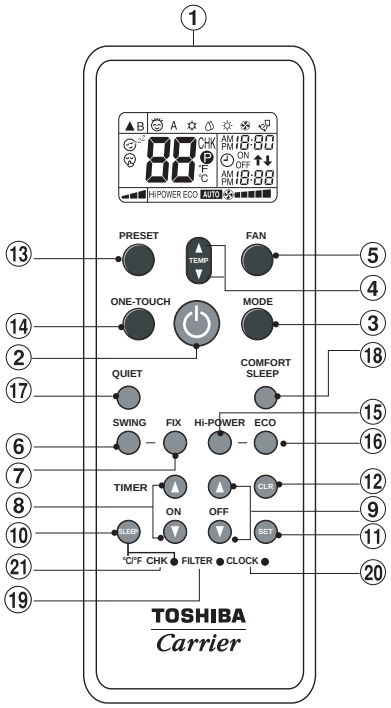
9-3-3. Power Failure During Timer Operation

- If Timer operation is set and the power supply shut down accidentally, the previous Timer setting will be cancelled.
- Daily-Timer operation will be not affected by power supply failure, if the remote controller is located on the position which it can send the command signal to the indoor unit. It is because the remote controller will send signal every 30 minutes and Daily-Timer operation will be restore.

9-4. Remote controller and Its functions

9-4-1. Parts name of remote controller

① Infrared signal emitter
② Start/Stop button
③ Mode select button (MODE)
④ Temperature button (TEMP)
⑤ Fan speed button (FAN
⑥ Swing louver button (SWING)
⑦ Set louver button (FIX)
⑧ On timer button (ON)
⑨ Off timer button (OFF)
⑩ Sleep timer button (SLEEP)
⑪ Setup button (SET)
⑫ Clear button (CLR)
⑬ Memory and Preset button (PRESET)
⑭ One Touch button (ONE-TOUCH)
⑮ High power button (Hi-POWER)
⑯ Economy button (ECO)
⑰ Quiet button (QUIET)
⑱ Comfort sleep button (COMFORT SLEEP)
⑲ Filter reset button (FILTER)
⑳ Clock Reset button (CLOCK)
㉑ Check button (CHK)



9-4-2. Operation of remote control

1. ONE-TOUCH

Press the "ONE-TOUCH" button for fully automated operation that is customised to the typical consumer preferences in your region of the world. The coutomised settings control temperature air flow strength, air flow direction and other settings to provide you alternate contact with "ONE-TOUCH" OF THE BUTTON. If you prefer other settings you can select from the many other operation functions of your Toshiba carrier unit

Press ● ONE-TOUCH : Start the operaton.

2. AUTOMATIC OPERATION

To automatically select cooling, heating, or fan only operation.

1. Press ● MODE : Select A.
2. Press TEMP : Set the desired temperature.

3. COOLING / HEATING / FAN ONLY OPERATION

1. Press ● MODE : Select Cool, Heat, or Fan only.
2. Press TEMP : Set the desired temperature.
   Cooling: Min. 62°F (17°C), Heating : Max, 86°F (30°C), Fan Only: No temperature indication
3. Press ● FAN : Select AUTO, LOW, LOW+, MED, MED+, or HIGH.

4. DRY OPERATION (COOLING ONLY)

For dehumidification, a moderate cooling performance is controlled automatically.

1. Press ● MODE : Select Dry 💧 .
2. Press TEMP : Set the desired temperature.

5. Hi-POWER OPERATION

To automatically control room temperature and airflow for faster cooling or heating operation (except in DRY and FAN ONLY mode)

Press ● HI-POWER : Start and stop the operation.

6. ECO OPERATION

To automatically control room to save energy (except in DRY and FAN ONLY mode)

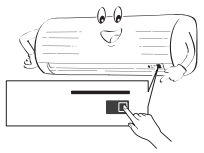
Press ● ECO : Start and stop the operation.

Note: Cooling operation; the set temperature will increase automatically 1.8°F (1°C)/ hour for 2 hours (maximum 3.6°F (2°C) increase). For heating operation the set temperature will decrease.

7. TEMPORARY OPERATION

In case of the misplaced or discharged remote control

- Pressing the RESET button, the unit can start or stop without using the remote control.
- Operation mode is set on AUTOMATIC operation, preset temperature is 75°F (24°C) and fan operation is automatic speed.



8. TIMER OPERATION

	Setting the ON Timer	Setting the OFF Timer
1	Press ▲ ON ▼ : Set the desired ON timer.	Press ▲ OFF ▼ : Set the desired OFF timer.
2	Press SET : Set the timer	Press SET : Set the timer.
3	Press CLR : Cancel the on timer	Press CLR : Cancel the OFF timer.

Everyday timer allows the user to set both the ON & OFF timers and will be activated on a daily basis.

Setting Everyday Timer

1	Press ▲ ON ▼ : Set the ON timer.	3	Press SET.
2	Press ▲ OFF ▼ : Set the OFF timer.	4	Press SET button during the (⬆ or ⬇) mark flashing.

- During the every day timer is activation, both arrows (⬆ or ⬇) are indicated.

Note:

- Keep the remote control in accessible transmission to the indoor unit; otherwise, the time lag of up to 15 minutes will occur.
- The setting will be saved for the next same operation.

9. PRESET OPERATION

Set your preferred operation for future use. The setting will be memorized by the unit for future operation (except air flow direction).

1. Select your preferred operation.
2. Press and hold ● PRESET for 3 seconds to memorize the setting. The Ⓟ mark displays.
3. Press ● PRESET : Operate the preset operation.

10. AUTO RESTART OPERATION

To automatically restart the Air conditioner after the power failure (Power of the unit must be on.)

Setting

1. AUTO RESTART is an initial setting from factory.
   - Do not operate ON timer and OFF timer.
2. Press and hold the RESET button on the indoor unit for 3 seconds to cancel the operation. (3 beep sound but OPERATION lamp does not blink)

11. QUIET OPERATION

To operate at super low fan speed for quiet operation (except in DRY mode)

Press ● QUIET : Start and stop the operation.

Note: Under certain conditions, QUIET operation may not provide adequate cooling or heating due to low sound features.

12. COMFORT SLEEP OPERATION

To save energy while sleeping, automatically control air flow and automatically turn OFF.

Press ● COMFORT SLEEP : Select 1, 3, 5 or 9 hrs for OFF timer operation.

Note: The cooling operation, the set temperature will increase automatically 1.8°F (1°C)/hour for 2 hours (maximum 3.6°F (2°C) increase). For heating operation, the set temperature will decrease.

13. SLEEP TIMER OPERATION

To start the sleep timer (OFF timer) operation

Press ● SLEEP : Select 1, 3, 5 or 9 hrs for OFF timer operation.

9-4-3. Name and Functions of Indications on Remote Controller

[Display]

All indications, except for the clock time indicator, are displayed by pressing the ⏻ button.

1 **Transmission mark**

This transmission mark ▲ indicates when the remote controller transmits signals to the indoor unit.

2 **Mode indicator**

Indicates the current operation mode.
(A : Automatic control ☼ : Cool,
💧 : Dry, ☼ : Heat, 🌀 : Fan only)

3 **Temperature indicator**

Indicates the temperature setting.
[62°F to 86°F (17°C to 30°C)]

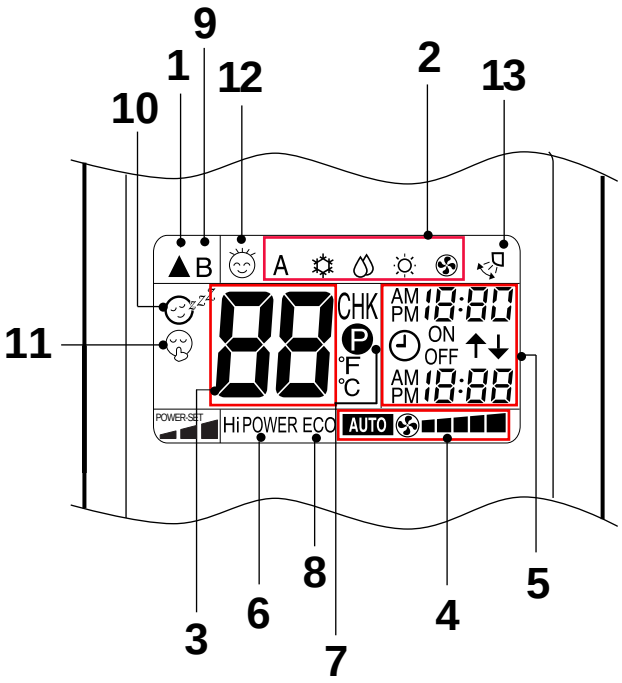
4 **FAN speed indicator**

Indicates the selected fan speed.

AUTO or five fan speed levels

(LOW ▁ , LOW⁺ ▁▂ , MED ▁▂▃ , MED⁺ ▁▂▃▄ , HIGH ▁▂▃▄▅) can be shown.

Indicates AUTO when the operating mode is either AUTO or 💧 : Dry.



5 **TIMER and clock time indicator**

The time setting for timer operation or the clock time is indicated.

The current time is always indicated except during TIMER operation.

6 **Hi-POWER indicator**

Indicates when the Hi-POWER operation starts.

Press the Hi-POWER button to start and press it again to stop the operation.

7 **Ⓟ (PRESET) indicator**

Flashes for 3 seconds when the PRESET button is pressed during operation.

The Ⓟ mark is shown when holding down the button for more than 3 seconds while the mark is flashing.

Press another button to turn off the mark.

8 **ECO indicator**

Indicates when the ECO is in activated.

Press the ECO button to start and press it again to stop operation.

9 **A, B change indicator remote controller**

When the remote controller switching function is set, “B” appears in the remote controller display. (When the remote controller setting is “A”, there is no indication at this position.)

10 ***Comfort sleep***

Indicates when comfort sleep is activaled.
Press comfort sleep button to select function.

11 ***Quiet***

Indicates when quiet is activated.
Press quiet button to start and press it again to stop operation.

12 ***One-Touch***

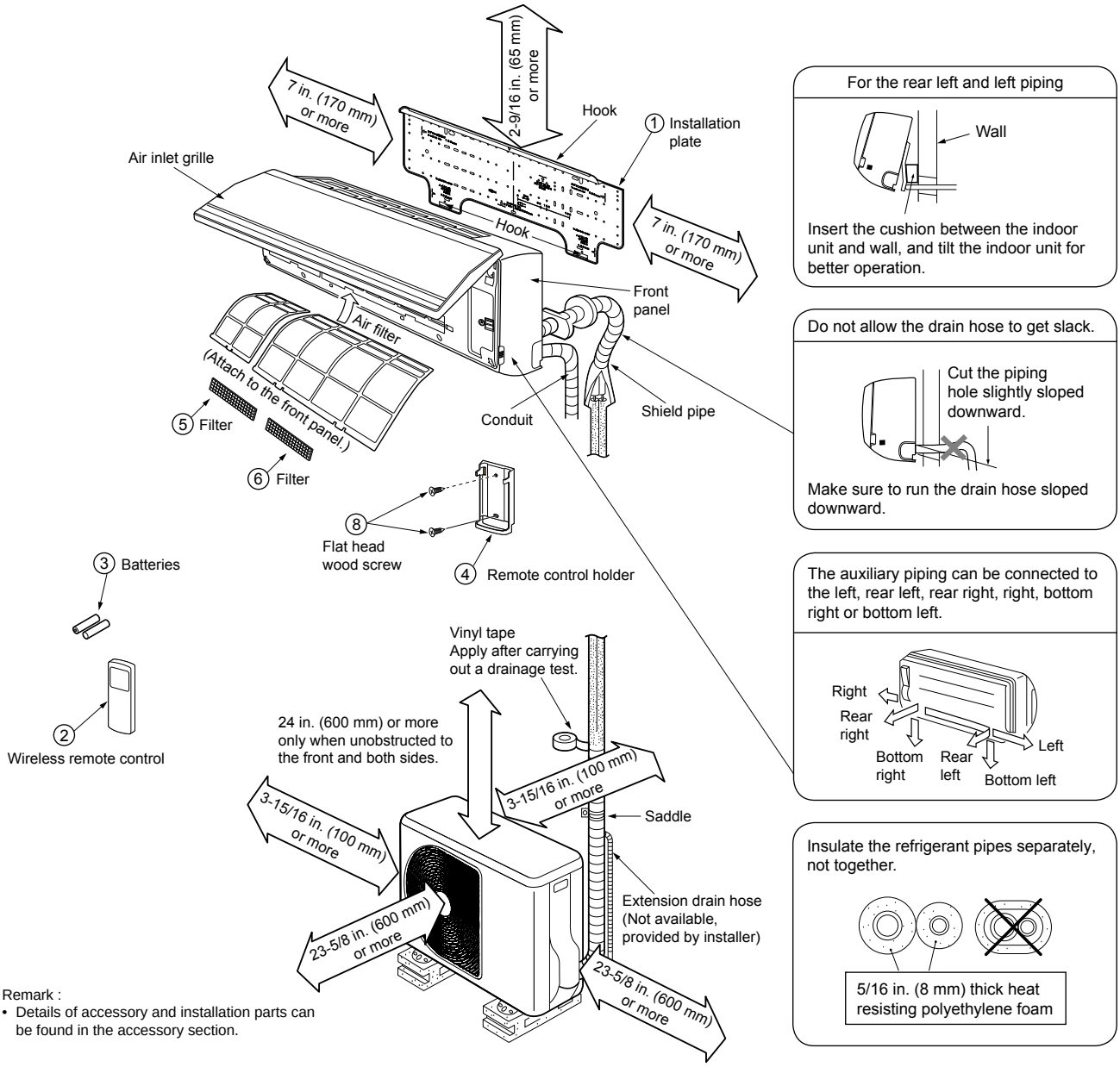
Indicates when one touch comfort is activated.
Press one-touch button to start the operation.

13 ***Swing***

Indicates when louver is swing.
Press swing button to start the swing operation and press it again to stop the swing operation.

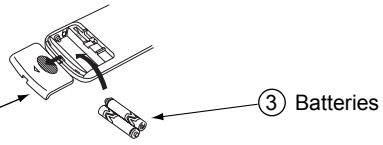
10. INSTALLATION PROCEDURE

10-1. Installation Diagram of Indoor and Outdoor Units


7 in. (170 mm) or more
2-9/16 in. (65 mm) or more
Hook
① Installation plate
Air inlet grille
Hook
7 in. (170 mm) or more
Front panel
Air filter
(Attach to the front panel.)
⑤ Filter
⑥ Filter
Conduit
Shield pipe
⑧ Flat head wood screw
④ Remote control holder
③ Batteries
② Wireless remote control
Vinyl tape
Apply after carrying out a drainage test.
24 in. (600 mm) or more only when unobstructed to the front and both sides.
3-15/16 in. (100 mm) or more
3-15/16 in. (100 mm) or more
Saddle
Extension drain hose (Not available, provided by installer)
23-5/8 in. (600 mm) or more
23-5/8 in. (600 mm) or more
Remark :
• Details of accessory and installation parts can be found in the accessory section.
For the rear left and left piping
Wall
Insert the cushion between the indoor unit and wall, and tilt the indoor unit for better operation.
Do not allow the drain hose to get slack.
Cut the piping hole slightly sloped downward.
Make sure to run the drain hose sloped downward.
The auxiliary piping can be connected to the left, rear left, rear right, right, bottom right or bottom left.
Right
Rear right
Left
Bottom right
Rear left
Bottom left
Insulate the refrigerant pipes separately, not together.
5/16 in. (8 mm) thick heat resisting polyethylene foam

Before installing the wireless remote controller

- Loading Batteries
  1. Remove the battery cover.
  2. Insert 2 new batteries (AAA type) following the (+) and (–) positions.



10-2. Installation

10-2-1. Field supplied installation part

Part Code	Parts name	Q'ty
Ⓐ	Refrigerant piping Liquid side : ∅1/4 in. (∅6.35 mm) Gas side : ∅3/8 in. (∅9.52 mm)	One each
Ⓑ	Pipe insulating material (polyethylene foam, 5/16 in. (8 mm) thick)	1
Ⓒ	Putty, PVC tapes	One each

<Fixing bolt arrangement of outdoor unit>

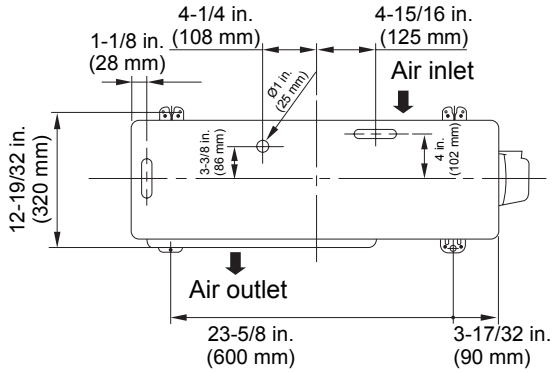
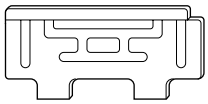
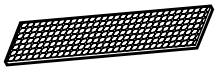


Fig. 10-2-1

- Secure the outdoor unit with fixing bolts and nuts if the unit is likely to be exposed to a strong winds.
- Use ∅5/16 in. (∅8 mm) or ∅3/8 in. (∅10 mm) anchor bolts and nuts.

10-2-2. Accessory and installation parts

Part No.	Part name (Q'ty)	Part No.	Part name (Q'ty)	Part No.	Part name (Q'ty)
①	 Installation plate x 1	④	Remote control holder x 1	⑦	Mounting screw ∅4 x 25 ℓ x 6
②	Wireless remote control x 1	⑤	 Toshiba New IAQ filter (L) x 1	⑧	Flat head wood screw ∅3.1 x 16 ℓ x 2
③	Battery x 2	⑥	Toshiba New IAQ filter (L) x 1		

Others

Name
Owner's manual
Installation manual

10-2-3. Installation/Servicing Tools

Changes in the product and components

In the case of an air conditioner using R410A, in order to prevent any other refrigerant from being charged accidentally, the service port diameter of the outdoor unit control valve (3 way valve) has been changed. (1/2 UNF 20 threads per inch)

- In order to increase the pressure resisting strength of the refrigerant piping flare processing diameter and size of opposite side of flare nuts has been changed. (for copper pipes with nominal dimensions 1/2 and 5/8)

New tools for R410A

New tools for R410A	Applicable to R22 model		Changes
Gauge manifold	×		As pressure is high, it is impossible to measure by means of conventional gauge. In order to prevent any other refrigerant from being charged, each port diameter has been changed.
Charge hose	×		In order to increase pressure resisting strength, hose materials and port size have been changed (to 1/2 UNF 20 threads per inch). When purchasing a charge hose, be sure to confirm the port size.
Electronic balance for refrigerant charging	○		As pressure is high and gasification speed is fast, it is difficult to read the indicated value by means of charging cylinder, as air bubbles occur.
Torque wrench (nominal diam. 1/2, 5/8)	×		The size of opposite sides of flare nuts have been increased. Incidentally, a common wrench is used for nominal diameters 1/4 and 3/8.
Flare tool (clutch type)	○		By increasing the clamp bar's receiving hole, strength of spring in the tool has been improved.
Gauge for projection adjustment	–	–	Used when flare is made by using conventional flare tool.
Vacuum pump adapter	○		Connected to conventional vacuum pump. It is necessary to use an adapter to prevent vacuum pump oil from flowing back to the charge hose. The charge hose connecting part has two ports-one for conventional refrigerant (7/16 UNF 20 threads per inch) and one for R410A. If the vacuum pump oil (mineral) mixes with R410A a sludge may occur and damage the equipment.
Gas leakage detector	×		Exclusive for HFC refrigerant.

- Incidentally, the "refrigerant cylinder" comes with the refrigerant designation (R410A) and protector coating in the U. S's ARI specified rose color (ARI color code: PMS 507).
- Also, the "charge port and packing for refrigerant cylinder" require 1/2 UNF 20 threads per inch corresponding to the charge hose's port size.

10-3. Outdoor Unit

10-3-1. Installation Location

- A location which provides enough spaces around the outdoor unit as shown in the diagram above.
- A location which can bear the weight of the outdoor unit and does not allow an increase in noise level and vibration.
- A location where the operation noise and discharged air do not disturb your neighbors.
- A location which is not exposed to a strong winds
- A location free of combustible gases leaks.
- A location which does not block a passage.
- A location where drain water does not cause any problems.
- Depending on snow level, use a field fabricated ice or snow stand.
- When the outdoor unit is to be installed in an elevated position, be sure to secure its feet as described in the section above.

Precautions about Installation is Regions with Snowfall and Cold Temperatures

- Do not use the supplied drain nipple for draining water. Drain the water from all drain holes directly.
- To protect the outdoor unit from snow accumulation, install a holding frame, and attach a snow protection hood and plate.
- Do not use a double-stacked design.

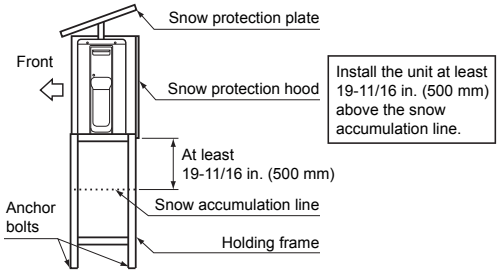

Snow protection plate
Front
Snow protection hood
Install the unit at least 19-11/16 in. (500 mm) above the snow accumulation line.
At least 19-11/16 in. (500 mm)
Anchor bolts
Snow accumulation line
Holding frame

Fig. 10-3-1

CAUTION

1. Install the outdoor unit in a location where there are no obstructions near its air intake or air outlet.
2. When the outdoor units is installed in a place that is always exposed to strong winds like on the coast or on a high story of a building, use a field fabricated wind baffle. To minimize the effect of strong winds, specially in windy areas, install the unit as shown below.

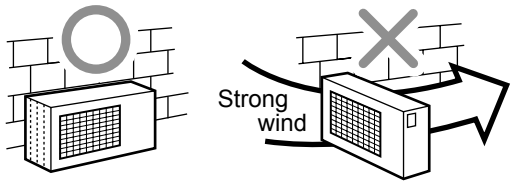


Fig. 10-3-2

10-3-2. Refrigerant Piping Connection

Flaring

1. Make sure you have enough pipe to reach indoor unit.
2. Cut the pipe with a pipe cutter.

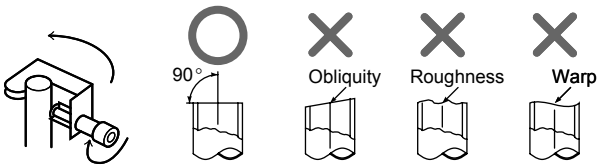


Fig. 10-3-3

3. Insert a flare nut into the pipe and flare the pipe.

Tightening connection

Align the centers of the connecting pipes and tighten the flare nut as far as possible with your fingers. Then tighten the nut with a two wrenches as show below.

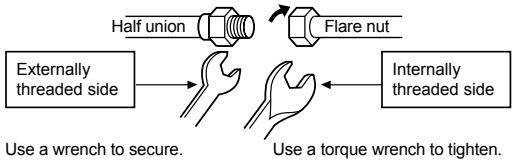


Fig. 10-3-4

CAUTION

Do not apply excess torque. Otherwise, the nut may crack depending on the conditions.

Outer dia. of copper pipe	Tightening torque
Ø1/4 in. (Ø6.35 mm)	10 to 13 lbf.ft (14 to 18 N·m)
Ø3/8 in. (Ø9.52 mm)	24 to 31 lbf.ft (33 to 42 N·m)

- **Tightening torque for connection of flare pipe**
  The pressure of R410A is higher than R22. (Approx. 1.6 times.) Therefore securely tighten the flare pipes which connect the outdoor unit and the indoor unit with the specified tightening torque using a torque wrench.

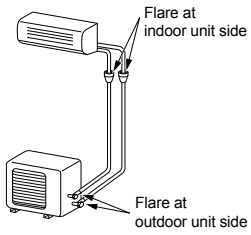


Fig. 10-3-5

10-3-3. Wiring Connection

NOTE

All wiring and connections must comply with NEC, CEC, and local codes.

- Connect all wires to the correct terminal on the wiring terminal blocks.
- Make sure that all connectors are secure.
- Size connectors per the ratings listed in the system requirement section.
- System interconnections should be minimum AWG14.

1. MOUNT THE OUTDOOR UNIT POWER DISCONNECT.
2. RUN POWER WIRING FROM MAIN BOX TO DISCONNECT PER NEC AND LOCAL CODES.
3. Remove the valve cover and the cord clamp from the outdoor unit.
4. Fix conduit connector to conduit plate by lock nut and secure it tightly. Connect the power supply and connecting cables to the terminal block as shown in the figure below and secure it tightly with screws.
5. You should not have extra cables.
6. Secure the power cord and the connceting cable with the cord clamp.
7. Attach the electric parts cover and the valve cover on the outdoor unit.
8. RUN PIPING AND INTERCONNECTING CABLE TO THE INDOOR UNIT.

10-3-4. Electrical Work

WARNING

ELECTRICAL SHOCK HAZARD
Failure to follow this warning could result in personal injury or death.
The unit cabinet must have an uninterrupted or unbroken ground to minimize personal injury if an electrical fault should occur. The ground may consist of electrical wire or metal conduit when installed in accordance with existing electrical codes.
Make sure main power switch is turned OFF before performing service or maintenance.

CAUTION

UNIT DAMAGE HAZARD
Failure to follow this caution may result in equipment damage or improper operation.
Unit failure as a result or of improper line voltage application or excessive phase imbalance constitutes abuse and may cause damage to electrical components. Such operation could void any applicable warranty.

1. The supply voltage must be the same as the rated voltage of the air conditioner.
2. Prepare the power source for exclusive use with the air conditioner.

NOTE : Power supply cord
- Wire type : minimum AWG14

Stripping length of the Power supply cord and Interconnecting cable

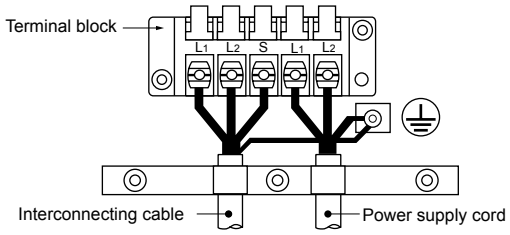


Fig. 10-3-6

Unit : inch (mm)

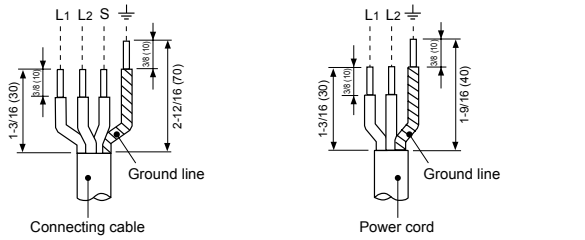


Fig. 10-3-7

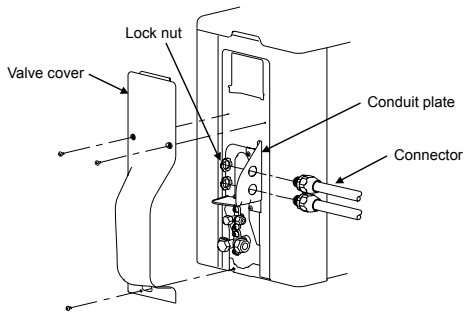


Fig. 10-3-8

CAUTION

- Wrong wiring connection may cause some electrical parts burn out.
- Be sure to comply with LOCAL CODES.
- Every wire must be connected firmly.
- If incorrect or incomplete wiring is carried out, it will cause an ignition or smoke.

NOTE : Interconnecting cable

- Wire type : minimum AWG14

10-4. Indoor Unit

10-4-1. Installation Location

- A location which provides clearances around the indoor unit as shown in the diagram in the "CLEARANCES" section.
- A location where there are no obstacles near the air inlet and outlet.
- A location which allows easy installation of the piping to the outdoor unit.
- A location which allows the front panel to be opened
- The indoor unit shall be installed such that the top of the indoor unit comes to at least 6.6 ft (2 m) height. Also avoid putting anything on the top of the indoor unit.
- A location that will bear the weight of the unit.

CAUTION

- Direct sunlight on the indoor unit's wireless receiver should be avoided.
- The microprocessor in the indoor unit should not be too close to RF noise sources. (For details, see the owner's manual.)

10-4-2. Cutting a Hole and Mounting the mounting Plate

Cutting a hole

When installing the refrigerant pipes from the rear.

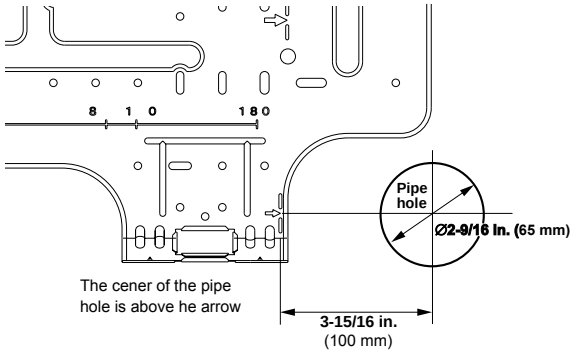


Fig. 10-4-1

After determining the pipe hole position on the mounting plate (⇨), drill the pipe hole ∅2-9/16 in. (∅65 mm) at a slight downward slant to the outdoor side.

NOTE :

- When drilling a wall that contains a metal lath, wire lath or metal plate, be sure to use a pipe hole brim ring sold separately.

Mounting the mounting plate

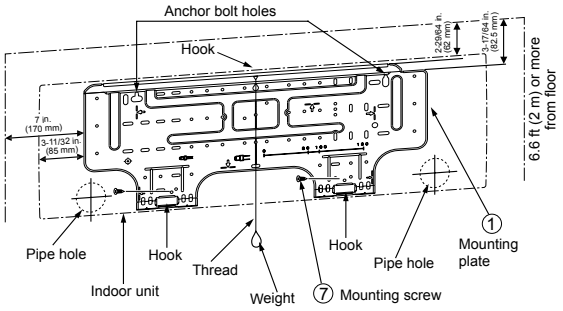


Fig. 10-4-2

When the installating plate is directly mounted to the wall

1. To hook up the indoor unit, securely fit the mounting plate onto the wall by screwing it in the upper and lower parts.
2. To mount the mounting plate on a concrete wall with, anchor bolts, drill the anchor bolt holes as illustrated in the figure shown below.
3. Make sure the mounting plate is leveled.

CAUTION

When installing the mounting plate with a mounting screw, do not use the anchor bolt holes. Otherwise, the unit may fall down and result in personal injury and property damage.

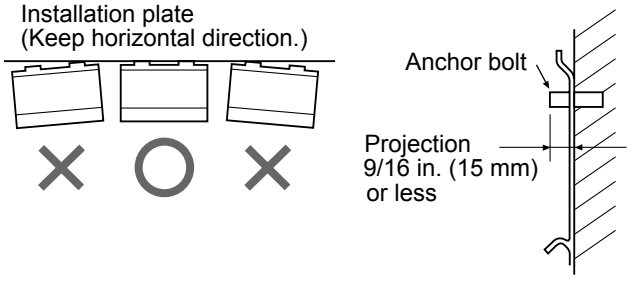


Fig. 10-4-3

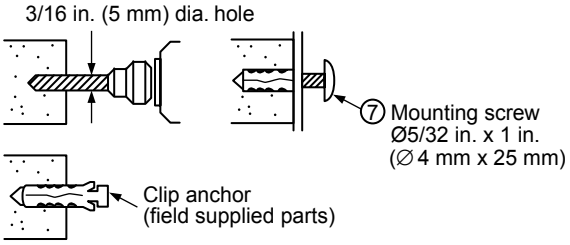


Fig. 10-4-4

CAUTION

Failure to firmly install the unit may result in personal injury and property damage if the unit falls.

- In case the unit is to be installed in a block, brick, concrete or similar type walls, make 3/16 in. (5 mm) dia. holes in the wall.
- Insert clip anchors for appropriate mounting screws p.

NOTE :

- Secure four corners and lower parts of the mounting plate with 4 to 6 mounting screws to install it.

10-4-2. Wiring Connection

How to connect the connecting cable

1. Open the air inlet grille upward.
2. Remove the screws securing the front panel.
3. Slightly open the lower part of the front panel, then pull the upper part of the front panel toward you to remove it from the rear plate.
4. Insert the conduit pipe (according to the local codes) into the pipe hole on the wall.
5. Remove the conduit mount by loosening the fixing screw. (Fig. 10-4-7)
6. Fix conduit pipe to conduit mount with the lock nut.
7. Pull out the connecting wire through the conduit pipe and process the wire. (Fig. 10-4-6)
8. Take out the wire to the front and fix it to the terminal block. Be careful not to mis-wire (Fig. 10-4-8)
9. Firmly tighten the terminal screws to prevent them from loosening. Tightening torque: 0.9 lbf. ft (1.2 N·m). After tightening, pull the wires lightly to confirm that they of not move.
10. Secure the connecting wire with the cord clamp.
11. Fix the conduit mount back to the body by fixing a screw.
12. Fix the front panel, terminal cover and air inlet grille to the indoor unit.

CAUTION

- Be sure to refer to the system wiring diagram located inside the front panel.
- Check local electrical codes and also any specific wiring instructions or limitations.

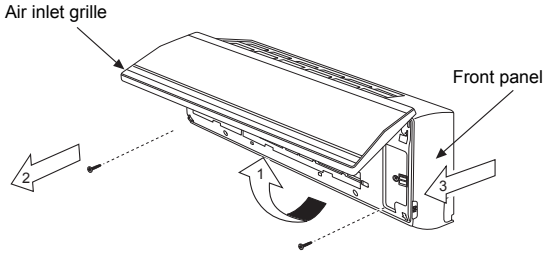


Fig. 10-4-5

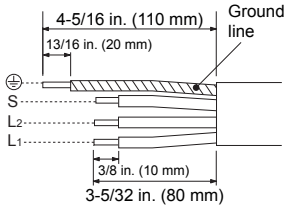


Fig. 10-4-6

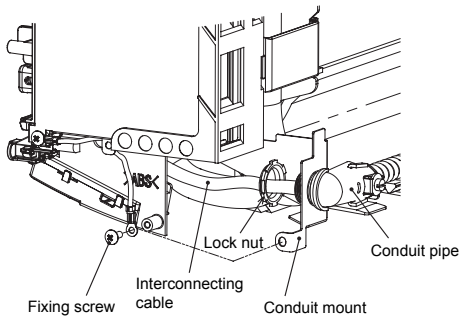


Fig. 10-4-7

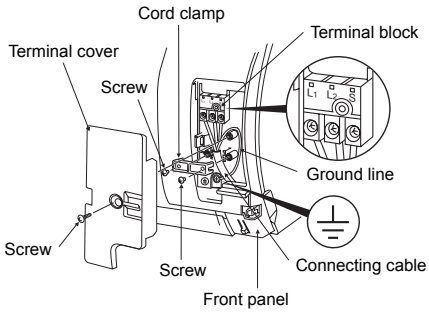


Fig. 10-4-8

NOTE :

- Use stranded wire only.
- Wire type : minimum AWG14

10-4-3. How to connect remote controller for wire operation> (Optional)

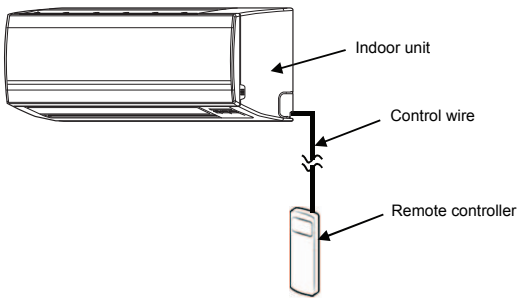


Fig. 10-4-9

<For indoor unit>

1. Open the air inlet grille upward.
2. Remove the screws securing the front panel.
3. Slightly open the lower part of the front panel then pull the upper part of the front toward you to remove it from the rear plate as shown in figure ①.
4. After removing the front panel, remove the control board assembly and open the cover as shown in figures ② and ③.
5. Arrange the control wire as specified and shown in figure ④.
6. Securely connect the control wire to the terminal of the control board as shown in figure ⑤ (tighten firmly but not over : 0.12 N·m (0.01 kgf·m).
7. Route the wire along the bottom of the control board and through the opening of the casing. Reassemble the control board assembly.
8. Route the wire along with the power supply and connecting cable as shown on figure ⑥ .
9. Reassemble the indoor unit by reversing processes 1 to 3.

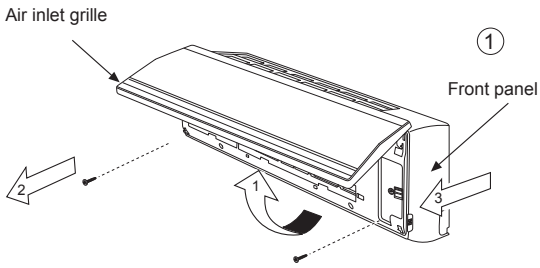
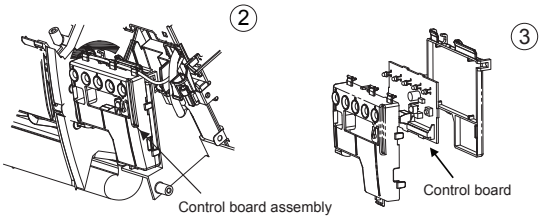


Fig. 10-4-10



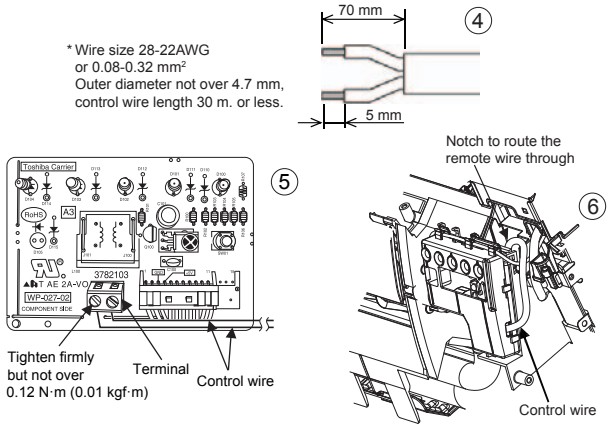


Fig. 10-4-11

<For remote controller>

1. Remove cover of remote controller by sliding down and taking it out.
2. If batteries are installed, please take them out. Do not install batteries for hard-wire installation.
3. With the help of a screwdriver hreak the polyester sheet as shown on figure ⑦.
4. Insert control wire from rear side of the remote controller as shown in figure ⑧.
5. With the provided screws, tighten the control wire to the aremote control terminal as shown in figure ⑩ (tightening btorque not to exceed 0.25 N-m (0.03 kgtk-m)) Wire specifications are shown in figure ⑨ .
6. Route the control wire through the gutter way at the rear side of remote controller as shown on figure ⑪.
7. Fix provided screw (∅1 3.1 x 16L) to the wall to hang remote controller as shown in figure ⑫ .
8. Mark and arrange a hole to fix the battery cover screw (∅ 3.1 x 25L) as shown in figure ⑫ .
9. Fix the battery cover to the remote controller and wall with the provided screw (∅ 3.1 x 25L) as shown in figure ⑬ .
   (tighten firmly but not over 0.15 N.m (0.02 kgf.m)).
10. Put back the remote controller cover.

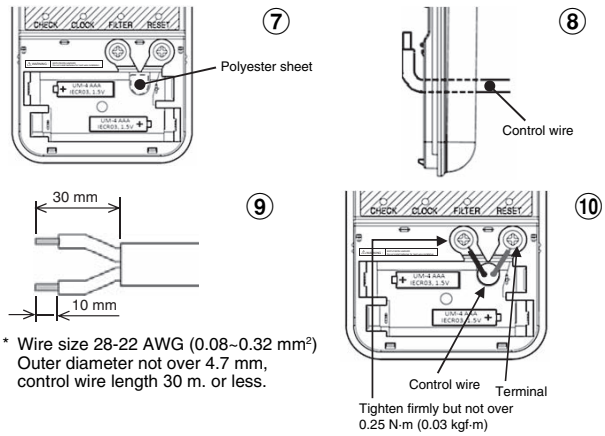


Fig. 10-4-12

⚠ WARNING :	EXPLOSION HAZARD Do not install batteries for hard wire installation

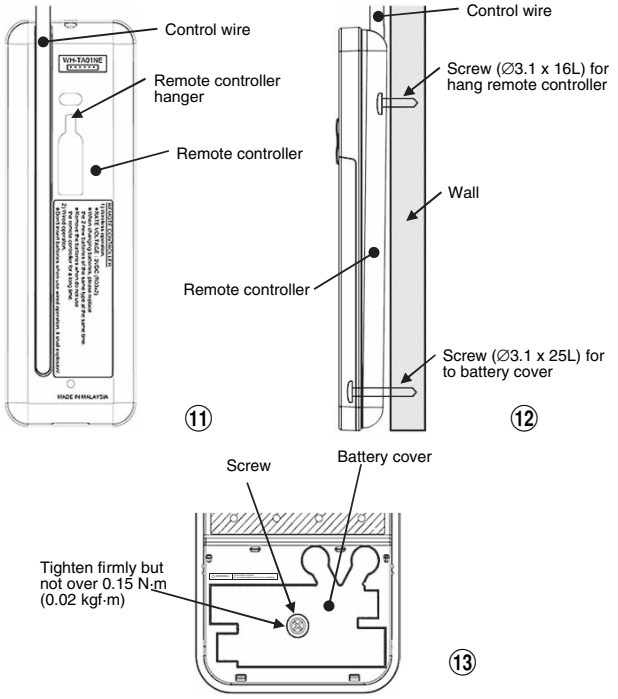


Fig. 10-4-13

***Remark :**

1. It is recommended to use double insulation lead wire to connect remote control to the air conditioner.
2. For hard-wire operation, 1 remote control can control only 1 indoor unit.
3. In wire operation, (PRESET, TIMER and CLOCK will return to their initial condition when the user shuts down the power supply to the air conditioner.

<How to install the air inlet grille on the indoor unit>

- When attaching the air inlet grille, perform the same process as for removal but in reverse order.

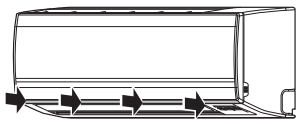
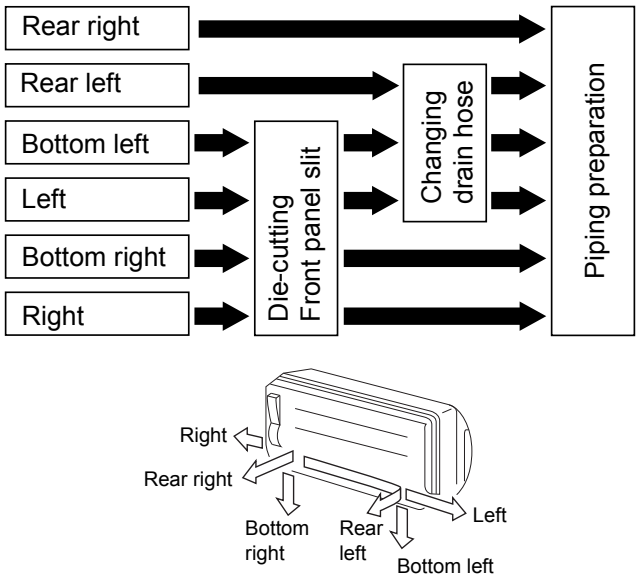


Fig. 10-4-14

10-4-4. Piping and drain hose installation

<Piping and drain hose forming>

INSULATE BOTH LINES



1. Die-cutting front panel slit

With a pair, of nippers, cut out the slit on the leftward or right side of the front panel for the left or right connection, and the slit on the bottom left or right side of the front panel for the bottom left ot right connection.

2. Changing drain hose

For leftward connection, bottom-leftward connection and rearleftward connection's piping, it is necessary to change the drain hose and drain cap.

How to remove the drain cap

Clip the drain cap with needle-nose pliers and pull out.

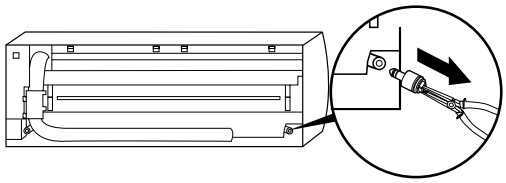


Fig. 10-4-15

How to remove the drain hose

- The drain hose can be removed by removing the screw securing the drain hose and then pulling out the drain hose.
- When removing the drain hose, be careful of any sharp edges the steel plate may have. Sharp edges can cause injuries.
- To install the drain hose, insert the drain hose firmly until the connection part contacts the heat insulator, and the secure it with the original screws.

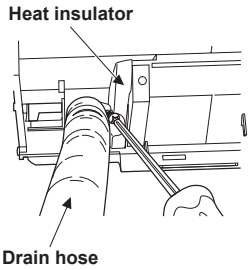


Fig. 10-4-16

How to fix the drain cap

1) Insert a hexagon wrench 3/16 in. (4 mm) in the center head of the cap.

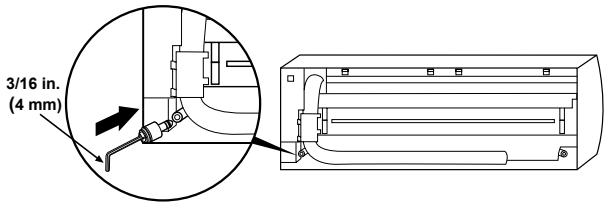


Fig. 10-4-17

2) Firmly insert the drain cap.

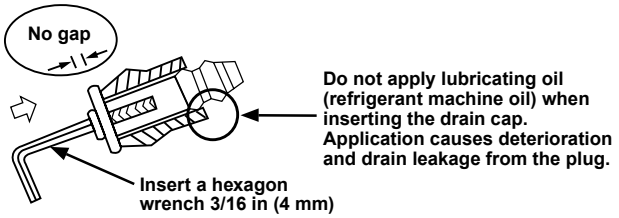

No gap
Do not apply lubricating oil (refrigerant machine oil) when inserting the drain cap. Application causes deterioration and drain leakage from the plug.
Insert a hexagon wrench 3/16 in (4 mm)

Fig. 10-4-18

CAUTION

Firmly insert the drain hose and drain cap; otherwise, water may leak.

<In case of right or left piping>

- After making slits of the front panel with a knife or a making-off pin, cut them with a pair of nippers or an equivalent tool.

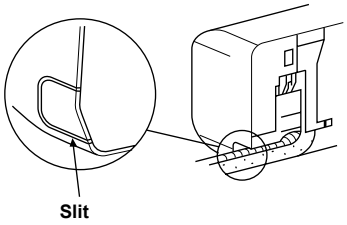


Fig. 10-4-19

<In case of bottom right or bottom left piping>

- After making slits of the front panel with a knife or a making-off pin, cut them with a pair of nippers or an equivalent tool.

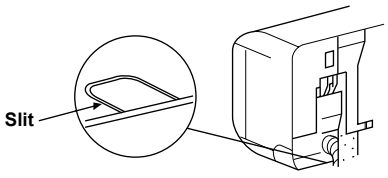


Fig. 10-4-20

<Left-hand connection with piping>

Bend the connecting pipe so that it is laid within 1-5/8 in. (43 mm) above the wall surface. If the connecting pipe is laid exceeding 1-5/8 in (43 mm) above the wall surface, the indoor unit may set on the wall unstably.
When bending the connecting pipe, make sure to use a spring bender to avoid crushing the pipe.

Bend the connecting pipe within a radius of 1-3/16 im. (30 mm.)

To connect he pipe after the unit has been installed (figure)

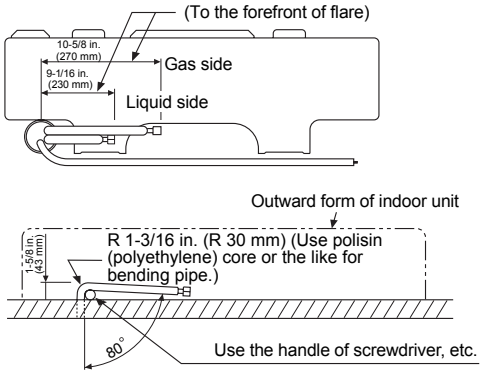

(To the forefront of flare)
10-5/8 in. (270 mm)
9-1/16 in. (230 mm)
Gas side
Liquid side
Outward form of indoor unit
1-5/8 in. (43 mm)
R 1-3/16 in. (R 30 mm) (Use polisin (polyethylene) core or the like for bending pipe.)
80°
Use the handle of screwdriver, etc.

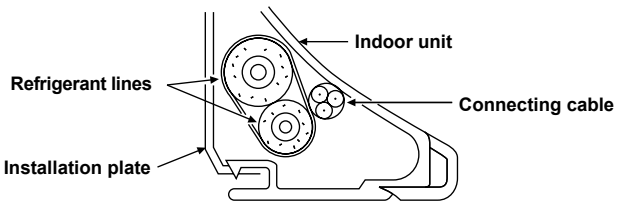
Fig. 10-4-21

NOTE

If the pipe is bent incorrectly, the indoor unit may set on the wall unstably.
After passing the connecting pipe through the pipe hole, connect the connecting pipes to the refrigerant line and wrap facing tape around them.

CAUTION

- Bind the refrigerant lines (two) and connecting cable with facing tape tightly. In case of leftward piping and rear-leftward piping, bind the refrigerant lines (two) only with facing tape.



- Carefully arrange pipes such that none of them stick out the rear plate of the indoor unit.
- Carefully connect the refrigerant lines and connecting pipes to one another and cut off the insulating tape wound on the connecting pipe to avoid double-taping at the joint, moreover, seal the joint with the vinyl tape, etc.
- Check for gas leaks before insulating.

10-4-5. Indoor Unit Fixing

1. Pass the pipe through the hole in the wall and hook the indoor unit on the upper hook of the installation plate.
2. Swing the indoor unit to right and left to confirm that it is firmly hooked up on the mounting plate.
3. While pressing the indoor unit onto the wall, hook in at the lower section of the mounting plate. Pull the indoor unit toward you to confirm that it is firmly hooked up on the mounting plate.

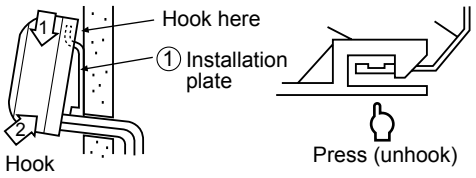


Fig. 10-4-22

- To detach the indoor unit from the mounting plate, pull the indoor unit toward you while pushing its bottom up as shown in the figure.

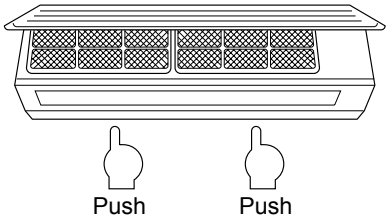


Fig. 10-3-23

10-4-6. Drainage

1. Run the drain hose slopping downward.

NOTE :

- The hole should be made at a slight downward slant on the outdoor side.
- The drain is internally trapped
  An external trap is not required

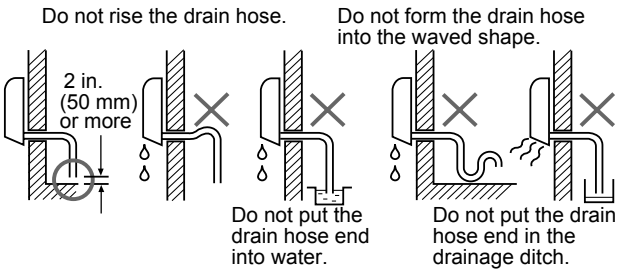

Do not rise the drain hose.
Do not form the drain hose into the waved shape.
2 in. (50 mm) or more
Do not put the drain hose end into water.
Do not put the drain hose end in the drainage ditch.

Fig. 10-4-24

2. Put water in the drain pan and make sure that the water is drained out.
3. When connecting an extension drain hose, insulate it with shield pipe.

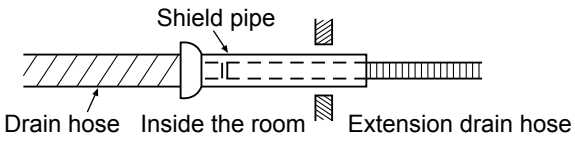


Fig. 10-4-25

CAUTION

Arrange the drain pipe for proper drainage from the unit.
Improper drainage can result in dew-dropping.

This air conditioner has the structure designed to drain water collected from dew, which forms on the back of the indoor unit, to the drain pan.

Therefore, do not store the power cord and other parts at a height above the drain guide.

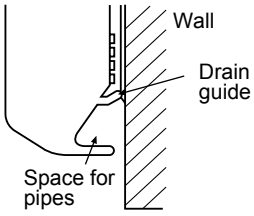


Fig. 10-4-26

Remote control

- Place the remote control away from obstacles (such as curtain) that may block the signal coming form the remote control.
  Do not install the remote control in a place exposed to direct sunlight or close to a heating source such as a stove.
  Keep the remote control at least 3.3 ft (1 m) apart from the nearest TV set or stereo equipment.
  (This is necessary to prevent image disturbances or noise interference.)
  The location of the remote control should be determined as shown below.

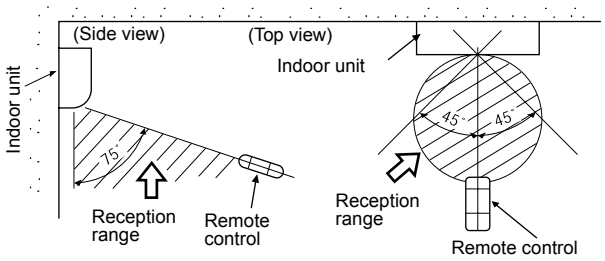


Fig. 10-4-27

Remote control A-B selection

In case of two systems operating nearby, follow the instructions below to set the remote control to operate with one indoor unit at a time.

Remote control B Setup.

1. Press RESET button on the indoor unit to turn the air conditioner ON.
2. Point the remote control at the indoor unit.
3. Push and hold CHK• button on the Remote Control with the tip of a pencil. "00" will be shown on the display.
4. Press MODE while pushing CHK• "B" will show on the display and "00" will disappear and the air conditioner will turn OFF B is now memorized.

Note :

1. Repeat above step to reset Remote Control back to A.
2. Remote Control does not display "A".
3. Detault setting of Remote Controller from factory is A.

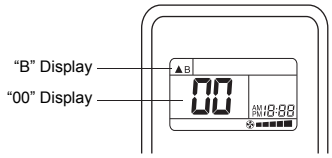


Fig. 10-4-28

10-5. EVACUATING

10-5-1. Evacuating

After the piping has been connected to the indoor unit, you vacuum both units as once.

Vacuuming

Evacuate the air in the connecting pipes and in the indoor unit using a vacuum pump. Do not re-use the refrigerant in the outdoor unit. For details, see the vacuum pump manual.

Using a vacuum pump

Be sure to use a vacuum pump with counter-flow prevention function so that inside oil of the pump does not flow backward into pipes of the air conditioner when the pump stops.
(If oil inside of the vacuum pump enters the air conditioner, which uses R410A, refrigeration cycle trouble may happen.)

1. Connect the charge hose from the manifold valve to the service port of the packed valve at gas side.
2. Connect the charge hose to the port of the vacuum pump.
3. Open fully the low pressure side handle of the manifold valve gauge.
4. Operate the vacuum pump to start evacuating. Perform evacuaion for about 15 minutes if the piping length is 66 feet (20 m).
   (assuming a pump capacity of 27 liters per minute)
   Then confirm that the compound pressure gauge reading is -101 kPa (-76 cmHg).
5. Close the low pressure side valve handle of the manifold valve gauge.
6. Open fully the valve stem of the packed valves (both gas and liquid sides).
7. Remove the charging hose from the service port.
8. Securely tighten the caps of packed valves.

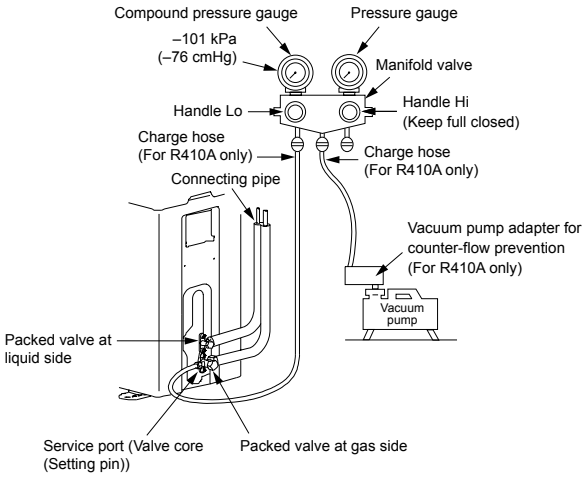


Fig. 10-5-1

CAUTION

- **5 IMPORTANT POINTS FOR PIPING WORK.**

  (1) Take away dust and moisture (inside of the connecting pipes).
  (2) Tighten the connections (between pipes and unit).
  (3) Evacuate the air in the connecting pipes using a VACUUM PUMP.
  (4) Check gas leak (connected points).
  (5) Be sure to fully open the packed valves before operation.
- **UNIT DAMAGE HAZARD**
  Failure to follow this caution may result in equipment damage or improper operation.
  Never use the system compressor as a vacuum pump.

10-5-2. Packed valve handling precautions

- Open the valve stem all the way out, but do not try to open it beyond the stopper.

Pipe size of Packed Valve	Size of Hexagon wrench
1/2 in. (12.7 mm and smallers)	A = 3/16 in. (4 mm)

- Securely tighten the valve cap with torque in the following table:

Cap	Cap Size (H)	Torque
Valve Rod Cap	43/64 in. - 3/4 in. (H17 - H19)	10 to 13 lbf.ft (14~18 N·m)
	55/64 in. - 1-3/16 in. (H22 - H30)	24 to 31 lbf.ft (33~42 N·m)
Service Port Cap	35/64 in. (H14)	37 to 46 lbf.ft (50~62 N·m)
	43/64 in. (H17)	10 to 13 lbf.ft (14~18 N·m)

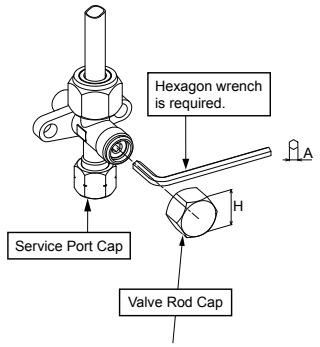


Fig. 10-5-2

10-6. SYSTEM REQUIREMENTS

10-6-1. Piping (Field supplied)

- Minimum refrigerant line length between the outdoor unit and indoor unit is 6.6ft. (2m).
- Maximum pipe lengths

Allowable Pipe length T (ft (m))	Height difference (Indoor – Outdoor H) (ft (m))
66 (20)	33 (10)

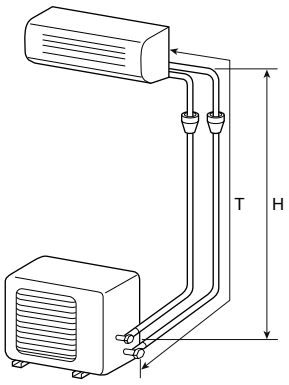


Fig. 10-6-1

Refrigerant pipe sizes

Liquid side		Gas side	
Outer Diameter In. (mm)	Thickness In. (mm)	Outer diameter In. (mm)	Thickness In. (mm)
Ø1/4 (6.35)	0.03 (0.8)	Ø3/8 (9.52)	0.03 (0.8)

Insulation

Both lines need to be insulated. Use a minimum 5/16 in (8mm) wall thickness.

Refrigerant charge

Unit : ft (m)

Refrigerant charge Length of refrigerant Pipe connected to Indoor/ outdoor unit	Additional refrigerant
6.6-50 (2-15m)	None
50-66 (15-20m)	Add 0.22oz/ft (20g/m) of Refrigerant for piping that exceeds 50ft (15m) up to 66ft (20m)

* Caution during addition of refrigerant Max. amount of additional refrigerant is 0.22 lbs (100g). Charge the refrigerant accurately. Overcharging may cause serious trouble to the compressor.

* Minimum refrigerant pipe is 6.6ft (2m). Using pipe shorter than that may cause a malfunction of the compressor or other components.

10-6-2. Power supply Connection and Connecting Cable

- The power supply shall be connected to the outdoor unit by 3 wires.
- The connecting cable between the indoor unit and outdoor unit is 4 wires. This cable provides the power for the indoor unit and the communication signal between the outdoor unit and indoor unit.
- Consult local building codes, NEC (National Electrical Code) or CEC (Canadian Electrical Code) for special requirements.
- The following are the electrical requirements.

Item \ Product Model		FCU	RAS-09EKV-UL	RAS-12EKV-UL
		CDU	RAS-09EAV-UL RAS-09EAV2-UL	RAS-12EAV-UL RAS-12EAV2-UL
MCA			10	13
MOCP (MAX Fuse/CB)			15	20
Breaker			15A	
Power supply cord (Not provide)	Connect to FCU/CDU		CDU	
	No. of Core		3 (L1, L2, ⏚)	
	Size		AWG14	
Interconnecting cable between FCU & CDU (Not provide)	No. of Core		4 (L1, L2, S,⏚)	
	Size		AWG14	

MCA = Minimum Circuit Amps

MOCP = Maximum Over Protection Device Amps

10-7. OTHERS

10-7-1. Gas Leak Test

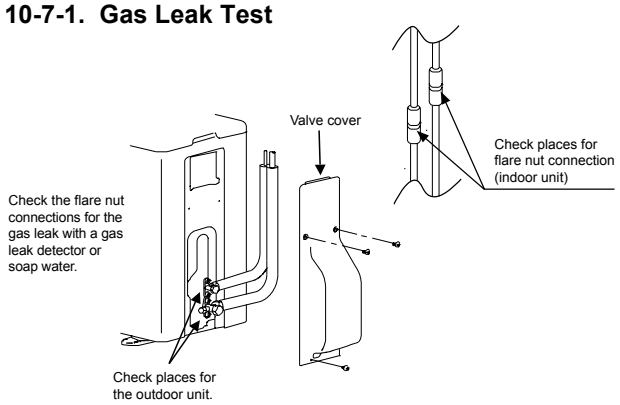

Valve cover
Check places for flare nut connection (indoor unit)
Check the flare nut connections for the gas leak with a gas leak detector or soap water.
Check places for the outdoor unit.

Fig. 10-7-1

10-7-2. Test Operation

To switch the TEST RUN (COOL) mode, press RESET button for 10 seconds. (The beeper will make a short beep.)

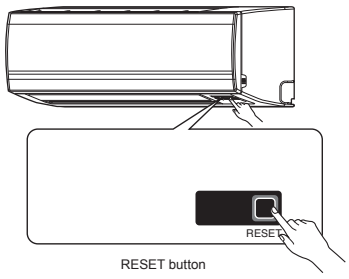


Fig. 10-7-2

10-7-3. Auto Restart Setting

This product is designed so that after a power failure it can restart automatically in the same operating mode as before the power failure.

Information

The product was shipped with Auto Restart function in the ON position. Turn it OFF if this function is not required.

10-7-4. How to cancel the Auto Restart

1. Press and hold the RESET button on the indoor unit for 3 seconds to cancel the operation. (3 beeps will sound but OPERATION lamp does not blink)
2. Press and hold the RESET button on the indoor unit for 3 seconds to set the operation. (3 beeps will sound and OPERATION lamp blink 5 time/sec for 5 seconds)
   · Do not operate ON timer and OFF timer.

Note: Default setting of auto restart operation is OK

10-7-5. Troubleshooting (Check Point)

The unit does not operate.	Cooling or Heating is abnormally low.
• The power main switch is turned off. • The circuit breaker is tripped. • ON timer is set.	• The filters are blocked with dust. • The temperature has been set improperly. • Windows or doors are open. • The air inlet or outlet of the outdoor unit is blocked. • The fan speed is too low. • The operation mode is FAN or DRY.

11. HOW TO DIAGNOSE THE TROUBLE

The pulse motor circuits are mounted to both indoor and outdoor units. Therefore, diagnose troubles according to the trouble diagnosis procedure as described below. (Refer to the check points in servicing written on the wiring diagrams attached to the indoor/outdoor units.)

Table 11-1

No.	Troubleshooting Procedure	Page
1	First Confirmation	62
2	Primary Judgment	63
3	Judgment by Flashing LED of Indoor Unit	63
4	Self-Diagnosis by Remote Controller	64
5	Judgment of Trouble by Every Symptom	67

No.	Troubleshooting Procedure	Page
6	How to Check Simply the Main Parts	72
7	Troubleshooting	73
8	How to Diagnose Trouble in Outdoor Unit	75
9	How to Check Simply the Main Parts	76
10	How to Simply Judge Whether Outdoor Fan Motor is Good or Bad	81

◆ Precautions when handling the new inverter (3DV Inverter)

⚠ CAUTION: HIGH VOLTAGEN

The high voltage circuit is incorporated.

Be careful to do the check service, as the electric shock may be caused in case of touching parts on the P.C. board by hand.

The new inverter (3DV inverter) will be incorporated starting with this unit.

(3DV: 3-shunt Discrete Vector control)

◆ The control circuitry has an uninsulated construction.

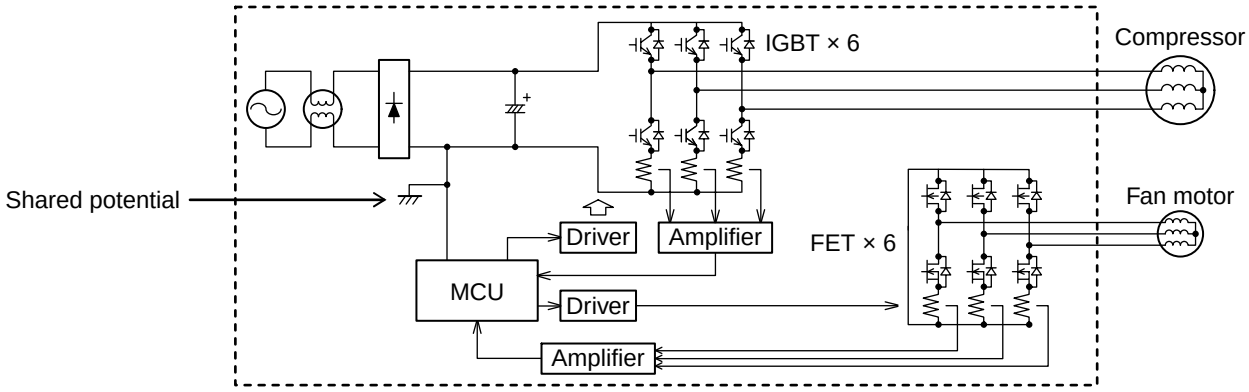


Fig. 11-1

⚠ CAUTION

A high voltage (equivalent to the supply voltage) is also energized to ground through the sensors, PMV and other low-voltage circuits. The sensor leads and other wires are covered with insulated tubes for protection. Nevertheless, care must be taken to ensure that these wires are not pinched.

Take sufficient care to avoid directly touching any of the circuit parts without first turning off the power.

At times such as when the circuit board is to be replaced, place the circuit board assembly in a vertical position.

Laying the board flat on an electrically conductive object (such as the top panel of the air conditioner's outdoor unit) while a charge is still retained by the electrolytic capacitors of the inverter's main circuit may cause short-circuiting between the electrolytic capacitors and secondary circuit components and result in damage to the components.

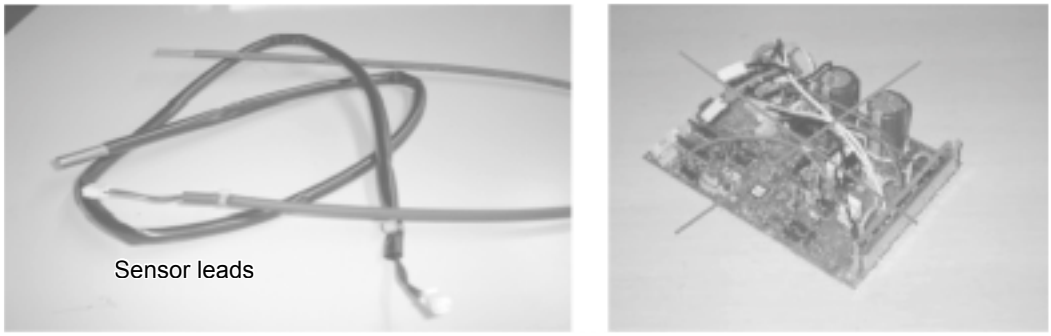


Fig. 11-2

Do NOT lay the circuit board assembly flat.

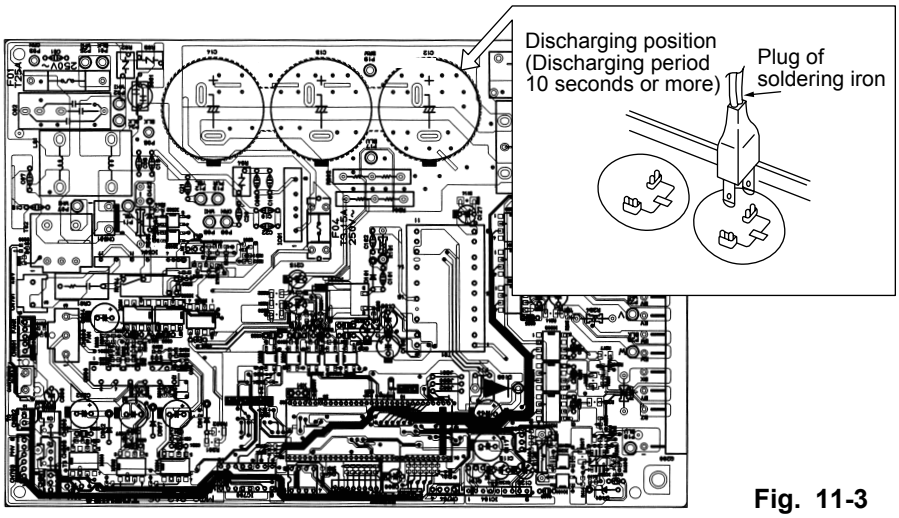
◆ Precautions when inspecting the control section of the outdoor unit

NOTE :

A large-capacity electrolytic capacitor is used in the outdoor unit controller (inverter). Therefore, if the power supply is turned off, charge (charging voltage DC265 to 360V) remains and discharging takes a lot of time. After turning off the power source, if touching the charging section before discharging, an electrical shock may be caused. Discharge the electrolytic capacitor completely by using soldering iron, etc.

< Discharging method >

1. Remove the inverter cover (plating) by opening four mounting claws.
2. As shown below, connect the discharge resistance (approx. 100Ω40W) or plug of the soldering iron to voltage between + – terminals of the C14 (“CAUTION HIGH VOLTAGE” is indicated.) electrolytic capacitor (500μF/400V) on P.C. board, and then perform discharging.



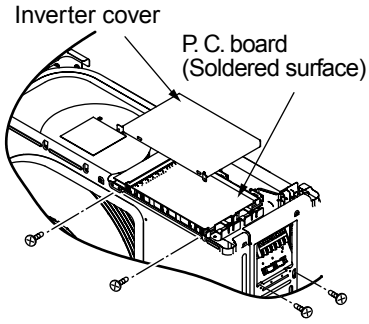


Fig. 11-3

11-1. First Confirmation

11-1-1. Confirmation of Power Supply

Confirm that the power breaker operates (ON) normally.

11-1-2. Confirmation of Power Voltage

Confirm that power voltage is AC 208–230 ± 10%.

If power voltage is not in this range, the unit may not operate normally.

11-1-3. Operation Which is not a Trouble (Program Operation)

For controlling the air conditioner, the program operations are built in the microcomputer as described in the following table.

If a claim is made for running operation, check whether or not it meets to the contents in the following table.

When it does, we inform you that it is not trouble of equipment, but it is indispensable for controlling and maintaining of air conditioner.

Table 11-1-1

No.	Operation of air conditioner	Description
1	When power breaker is turned “ON”, the operation indicator (Green) of the indoor unit flashes.	The OPERATION lamp of the indoor unit flashes when power source is turned on. If [⏻] button is operated once, flashing stops. (Flashes also in power failure)
2	Compressor may not operate even if the room temperature is within range of compressor-ON.	The compressor does not operate while compressor restart delay timer (3-minutes timer) operates. The same phenomenon is found after power source has been turned on because 3-minutes timer operates.
3	In Dry and ECO mode, FAN (air flow) display does not change even though FAN (air flow select) button is operated.	The air flow indication is fixed to [AUTO].
4	Increasing of compressor motor speed stops approx. 30 seconds after operation started, and then compressor motor speed increases again approx. 30 seconds after.	For smooth operation of the compressor, the compressor motor speed is restricted to Max. 41 rps for 2 minutes, and Max.91 rps for 2 minutes to 3 minutes, respectively after the operation has started.
5	In AUTO mode, the operation mode is changed.	After selecting Cool or Heat mode, select an operation mode again if the compressor keeps stop status for 15 minutes.
6	In HEAT mode, the compressor motor speed does not increase up to the maximum speed or decreases before the temperature arrives at the set temperature.	The compressor motor speed may decrease by high-temp. release control (Release protective operation by temp.-up of the indoor heat exchanger) or current release control.

11-2. Primary Judgment

To diagnose the troubles, use the following methods.

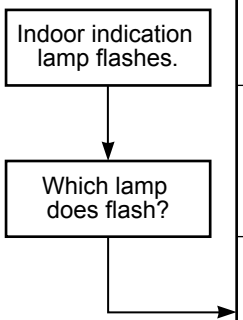
1) Judgment by flashing LED of indoor unit
2) Self-diagnosis by service check remote controller
3) Judgment of trouble by every symptom

Firstly use the method 1) for diagnosis. Then, use the method 2) or 3) to diagnose the details of troubles.

11-3. Judgment by Flashing LED of Indoor Unit

While the indoor unit monitors the operation status of the air conditioner, if the protective circuit operates, the contents of self-diagnosis are displayed with block on the indoor unit indication section.

Table 11-3-1



Item	Check code	Block display	Description for self-diagnosis
A	—	OPERATION (Green) Flashing display (1 Hz)	• When turn ON power supply. • Power supply ON after failure or OFF. • This flashing display is not air conditioner failure.
B	00	OPERATION (Green) Flashing display (5 Hz)	Protective circuit operation for indoor P.C. board
C	01	OPERATION (Green) TIMER (Yellow) Flashing display (5 Hz)	Protective circuit operation for connecting cable and serial signal system
D	02	OPERATION (Green) FILTER (Orange) Flashing display (5 Hz)	Protective circuit operation for outdoor P.C. board
E	03	OPERATION (Green) TIMER (Yellow) FILTER (Orange) Flashing display (5 Hz)	Protective circuit operation for others (including compressor)

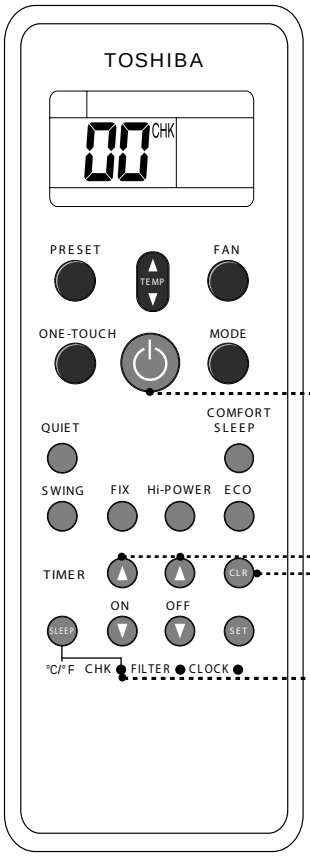
NOTES :

1. Some check code will flash display of the indoor unit, when the air conditioner operates with some limitation.
2. Some check code will flash display of the indoor unit and stop operation of the air conditioner.
3. When item B and C or item B and apart of item E occur concurrently, priority is given to the block of item B.
4. The check codes can be confirmed on the remote controller for servicing.

11-4. Self-Diagnosis by Remote Controller (Check Code)

1. If the lamps are indicated as shown B to E in Table 11-3-1, execute the self-diagnosis by the remote controller.
2. When the remote controller is set to the service mode, the indoor controller diagnoses the operation condition and indicates the information of the self-diagnosis on the display of the remote controller with the check codes. If a fault is detected, all lamps on the indoor unit will flash at 5Hz and it will beep for 10 seconds (Beep, Beep, Beep ...). The timer lamp usually flashes (5Hz) during self-diagnosis.

11-4-1. How to Use Remote Controller in Service Mode



Alphanumeric characters are used for the check codes.

5 is 5. 6 is 6.
A is A. b is B.
C is C. d is D.

1 **Press [CHECK] button with a tip of pencil to set the remote controller to the service mode.**

- " 00 " is indicated on the display of the remote controller.

2 **Press [ON▲] or [OFF▲] button**

If there is no fault with a code, the indoor unit will beep once (Beep) and the display of the remote controller will change as follows :

00 → 01 → 02 ··· 1d → 1E → 33

- The TIMER indicator of the indoor unit flashes continuously. (5 times per 1 sec.)
- Check the unit with all 52 check codes (00 to 33) as shown in Table-11-4-1.
- Press [ON▼] or [OFF▼] button to change the check code backward.

If there is a fault, the indoor unit will beep for 10 seconds (Beep, Beep, Beep...).

Note the check code on the display of the remote controller.

- 2-digits alphanumeric will be indicated on the display.
- All indicators on the indoor unit will flash. (5 times per 1 sec.)

3 **Press [CLR] button. After service finish for clear** service code in memory.

- "7F" is indicated on the display of the remote control.

4 **Press [⏻] button to release the service mode.**

- The display of the remote controller returns to as it was before service mode was engaged.

Fig. 11-4-1

11-4-2 Caution at Servicing

1. After using the service mode of remote controller finished, press the [⏻] button to reset the remote controller to normal function.
2. After finished the diagnosis by the remote controller, turn OFF power supply and turn its ON again to reset the air conditioner to normal operation. However, the check codes are not deleted from memory of the microcomputer.
3. After servicing finished, press [CLR] button of remote controller under service mode status to send code "7F" to the indoor unit. The check code stored in memory is cleared.

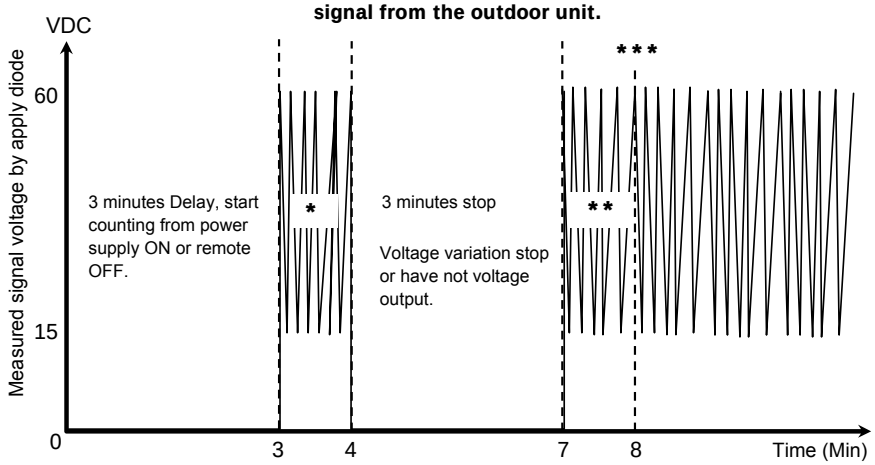
Table 11-4-1

Block distinction		Operation of diagnosis function				Action and Judgment
Check code	Block	Check code	Cause of operation	Air conditioner status	Display flashing error	
00	Indoor P.C. board.	0C	TA sensor ; The room temperature sensor is short-Circuit or disconnection.	Operation continues.	Flashes when error is detected.	1. Check the sensor TA and connection. 2. In case of the sensor and its connection is normal, check the P.C. board.
		0d	TC sensor ; The heat exchanger temperature sensor of the indoor unit is out of place, disconnection, short-circuit or migration.	Operation continues.	Flashes when error is detected.	1. Check the sensor TC and connection. 2. In case of the sensor and its connection is normal, check the P.C. board.
		11	Fan motor of the indoor unit is failure, lock-rotor, short-circuit, disconnection, etc. Or its circuit on P.C. board has problem.	All OFF	Flashes when error is detected.	1. Check the fan motor and connection. 2. In case of the motor and its connection is normal, check the P.C. board.
		12	Other trouble on the indoor P.C. board.	Depend on cause of failure.	Depend on cause of failure.	Replace P.C. board.

Block distinction		Operation of diagnosis function				Action and Judgment
Check code	Block	Check code	Cause of operation	Air conditioner status	Display flashing error	
01	Serial signal and connecting cable.	04	1) Defective wiring of the connecting cable or miss-wiring. 2) Operation signal has not send from the indoor unit when operation start. 3) Outdoor unit has not send return signal to the indoor unit when operation started. 4) Return signal from the outdoor unit is stop during operation. ● Some protector (hardware, if exist) of the outdoor unit open circuit of signal. ● Signal circuit of indoor P.C. board or outdoor P.C. board is failure in some period.	Indoor unit operates continue. Outdoor unit stop.	Flashes when error is detected. Flashing stop and outdoor unit start to operate when the return signal from the outdoor unit is normal.	1) to 3) The outdoor unit never operate. ● Check connecting cable and correct if defective wiring. ● Check 25A fuse of inverter P.C. board. ● Check 3.15A fuse of inverter P.C. board. ● Check operation signal of the indoor unit by using diode. Measure voltage at terminal block of the indoor unit between No.2 and No.3 (or L2 and S) If signal is varied 15-60V continuously, replace inverter P.C. board. If signal is not varied, replace indoor P.C. board. 4) The outdoor unit abnormal stop at some time. ● If the other check codes are found concurrently, check them together. ● Check protector (hardware) such as Hi-Pressure switch, Thermal-Relay, etc. ● Check refrigerant amount or any possibility case which may caused high temperature or high pressure. ● Check operation signal of the indoor unit by using diode. Measure voltage at terminal block of the indoor unit between No.2 and No.3 (or L2 and S) If signal is varied 15-60V continuously, replace inverter P.C. board. If signal is not varied, replace indoor P.C. board.

Note : Operation signal of the indoor unit shall be measured in the sending period as picture below.

Sending signal of the indoor unit when have not return signal from the outdoor unit.



* Signal send only 1 minute and stop. Because of return signal from outdoor unit has not received.

** Signal resend again after 3 minutes stop. And the signal will send continuously.

*** 1 minute after resending, the indoor unit display flashes error.

Block distinction		Operation of diagnosis function				Action and Judgment
Check code	Block	Check code	Cause of operation	Air conditioner status	Display flashing error	
02	Outdoor P.C. board	14	Current on inverter circuit is over limit in short time. ● Inverter P.C. board is failure, IGBT shortage, etc. ● Compressor current is higher than limitation, lock rotor, etc.	All OFF	Flashes after error is detected 4 times*.	1. Remove connecting lead wire of the compressor, and operate again. 2. If outdoor fan does not operate or operate but stop after some period, replace the inverter P.C. board. 3. If outdoor fan operates normally, measure 3-Phase output of inverter P.C. board (150-270VAC) at the connecting lead wire of compressor. 4. If 3-Phase output is abnormal, replace inverter P.C.Board. 5. If 3-Phase output is normal, replace compressor. (lock rotor, etc.)
		16	Compressor position-detect circuit error or short-circuit between winding of compressor.	All OFF	Flashes after error is detected 4 times*.	1. Remove connecting lead wire of the compressor, and operate again. 2. If outdoor fan does not operate or operation but stop after some period, replace the inverter P.C. board. 3. If outdoor fan operates normally, measure resistance of compressor winding. If circuit is shortage, replace the compressor.
		17	Current-detect circuit of inverter P.C. board error.	All OFF	Flashes after error is detected 4 times*.	Even if trying to operate again, all operations stop, replace inverter P.C. board.
		18	TE sensor ; The heat exchanger temperature sensor of the outdoor unit either TS sensor ; Suction pipe temperature sensor, out of place, disconnection or shortage.	All OFF	Flashes after error is detected 4 times*.	1. Check sensors TE, TS and connection. 2. In case of the sensors and its connection is normal, check the inverter P.C. board.
		19	TD sensor ; Discharge pipe temperature sensor is disconnection or shortage.	All OFF	Flashes after error is detected 4 times*.	1. Check sensors TD and connection. 2. In case of the sensor and its connection is normal, check the inverter P.C. board.
		1A	Outdoor fan failure or its drive-circuit on the inverter P.C. board failure.	All OFF	Flashes after error is detected 4 times*.	1. Check the motor, measure winding resistance, shortage or lock rotor. 2. Check the inverter P.C. board.
		1b	TO sensor ; The outdoor temperature sensor is disconnection or shortage.	Operation continues.	Record error after detected 4 times*. But does not flash display.	1. Check sensors TO and connection. 2. In case of the sensor and its connection is normal, check the inverter P.C. board.

Block distinction		Operation of diagnosis function				Action and Judgment
Check code	Block	Check code	Cause of operation	Air conditioner status	Display flashing error	
		11	Compressor drive output error. (Relation of voltage, current and frequency is abnormal) ● Overloading operation of compressor caused by over-charge refrigerant, P.M.V. failure, etc. ● Compressor failure (High current).	All OFF	Flashes after error is detected 4 times*.	1. Check installation conditions such as packed valve opening, refrigerant amount and power supply (rate ±10%, both of operation and non operation condition). 2. Check P.M.V. by measure the resistance of the coil and confirm its operation (sound of initial operation, etc.) 3. Observe any possibility cause which may affect operation load of compressor. 4. Operate again. If compressor operation is failure when 20 seconds passed (count time from operation starting of compressor), replace compressor.
	* 4 times ; When first error is detected, error is count as 1 time, then once operation is stop and re-started. After re-starting operation within 15 minutes, if same error is detected, error count is add (count become 2 times) When error count comes 4 times, record error to check code. But after re-starting operation, if no error is detected and air conditioner can operate more than 15 minutes, error count is cleared.					
03	The others (including compressor)	07	Return signal of the outdoor unit has been sent when operation start. But after that, signal is stop some time. ● Instantaneous power failure. ● Some protector (hardware) of the outdoor unit open circuit of signal. ● Signal circuit of indoor P.C. board or outdoor P.C. board is failure in some period.	Indoor unit operates continue. Outdoor unit stop.	Flashes when error is detected. Flashing stop and outdoor unit start to operate when the return signal from the outdoor unit is normal.	1. Check power supply (Rate ± 10%) 2. If the air conditioner repeat operates and stop with interval of approx. 10 to 40 minutes. ● Check protector (hardware) such as Hi-Pressure switch, Thermal-Relay, etc. ● Check refrigerant amount, packed valve opening and any possibility cause which may affect high temperature or high pressure. 3. Check operation signal of the indoor unit by using diode. Measure voltage at terminal block of the indoor unit between No.2 and No.3 (or L2 and S) If signal is varied 15-60V continuously, replace inverter P.C. board. If signal is not varied, replace indoor P.C. board.

Block distinction		Operation of diagnosis function				Action and Judgment
Check code	Block	Check code	Cause of operation	Air conditioner status	Display flashing error	
		1d	Compressor does not rotate. Because of missed wiring, missed phase or shortage.	All OFF	Flashes after error is detected 4 times*.	1. Remove connecting lead wire of the compressor, and operate again. 2. If outdoor fan does not operate or operation but stop after some period, replace the inverter P.C. board. 3. If outdoor fan operates normally, measure 3-Phase output of inverter P.C. board (150-270VAC) at the connecting lead wire of compressor. 4. If 3-Phase output is abnormal, replace inverter P.C.Board. 5. If 3-Phase output is normal, measure resistance of compressor winding. 6. If winding is shortage, replace the compressor.
		1E	Discharge temperature exceeded 117°C.	All OFF	Flashes after error is detected 4 times*.	1. Check sensors TD. 2. Check refrigerant amount. 3. Check P.M.V. by measure the resistance of the coil and confirm its operation (sound of initial operation, etc.) 4. Observe any possibility cause which may affect high temperature of compressor.
		1F	Compressor is high current though operation Hz is decreased to minimum limit. ● Installation problem. ● Instantaneous power failure. ● Refrigeration cycle problem. ● Compressor break down. ● Compressor failure (High current).operation, etc.)	All OFF	Flashes after error is detected 4 times*.	1. Check installation conditions such as packed valve opening, refrigerant amount and power supply (rate ±10%, both of operation and non operation condition). 2. Check P.M.V. by measure the resistance of the coil and confirm its operation (sound of initial operation, etc.) 3. Observe any possibility cause which may affect high current of compressor. 4. If 1, 2 and 3 are normal, replace compressor.

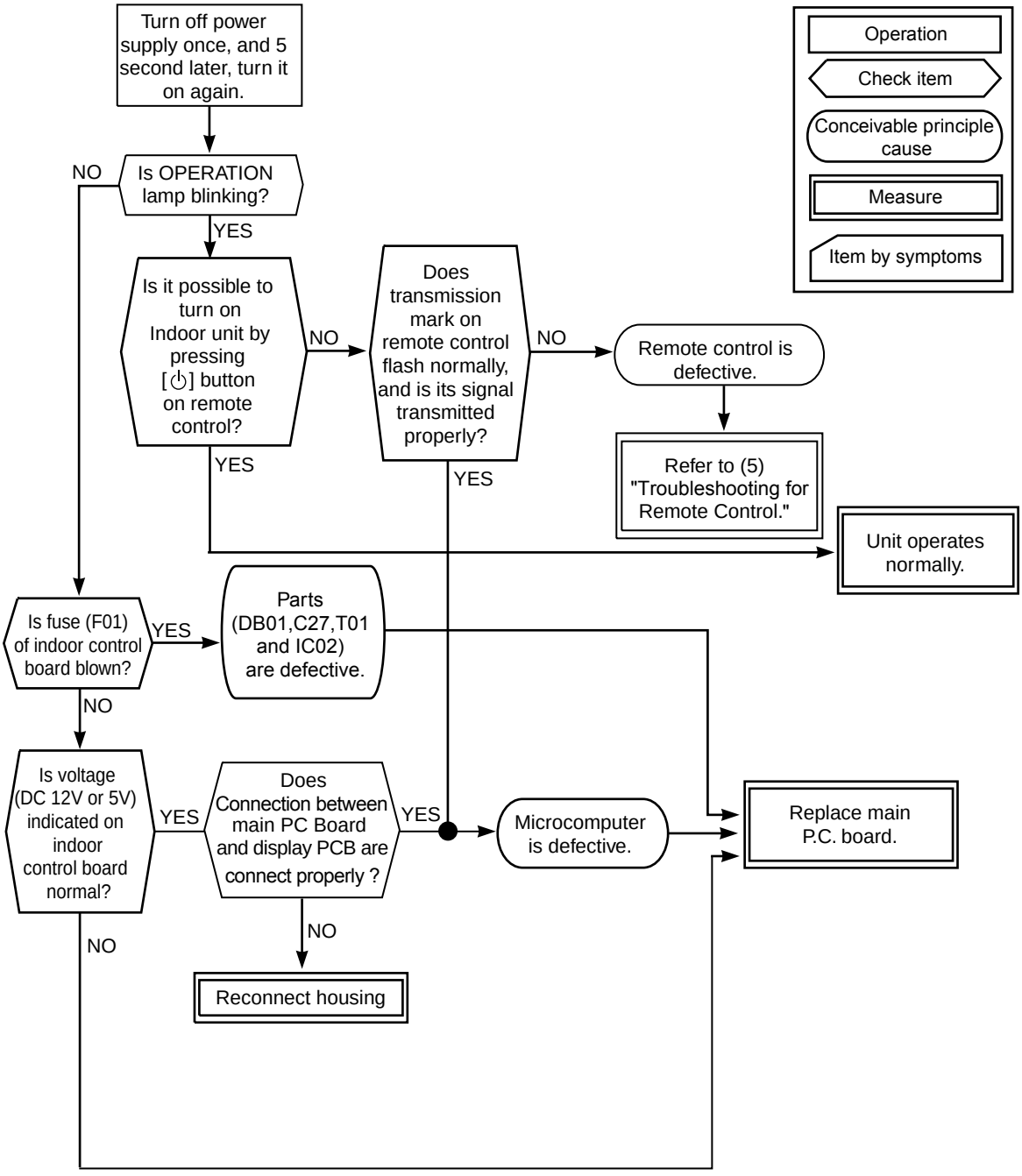
* 4 times ; When first error is detected, error is count as 1 time, then once operation is stop and re-started.
After re-starting operation within 15 minutes, if same error is detected, error count is add (count become 2 times)
When error count comes 4 times, record error to check code. But after re-starting operation, if no error is detected and air conditioner can operate more than 15 minutes, error count is cleared.

11-5. Judgement of Trouble by Every Symptom

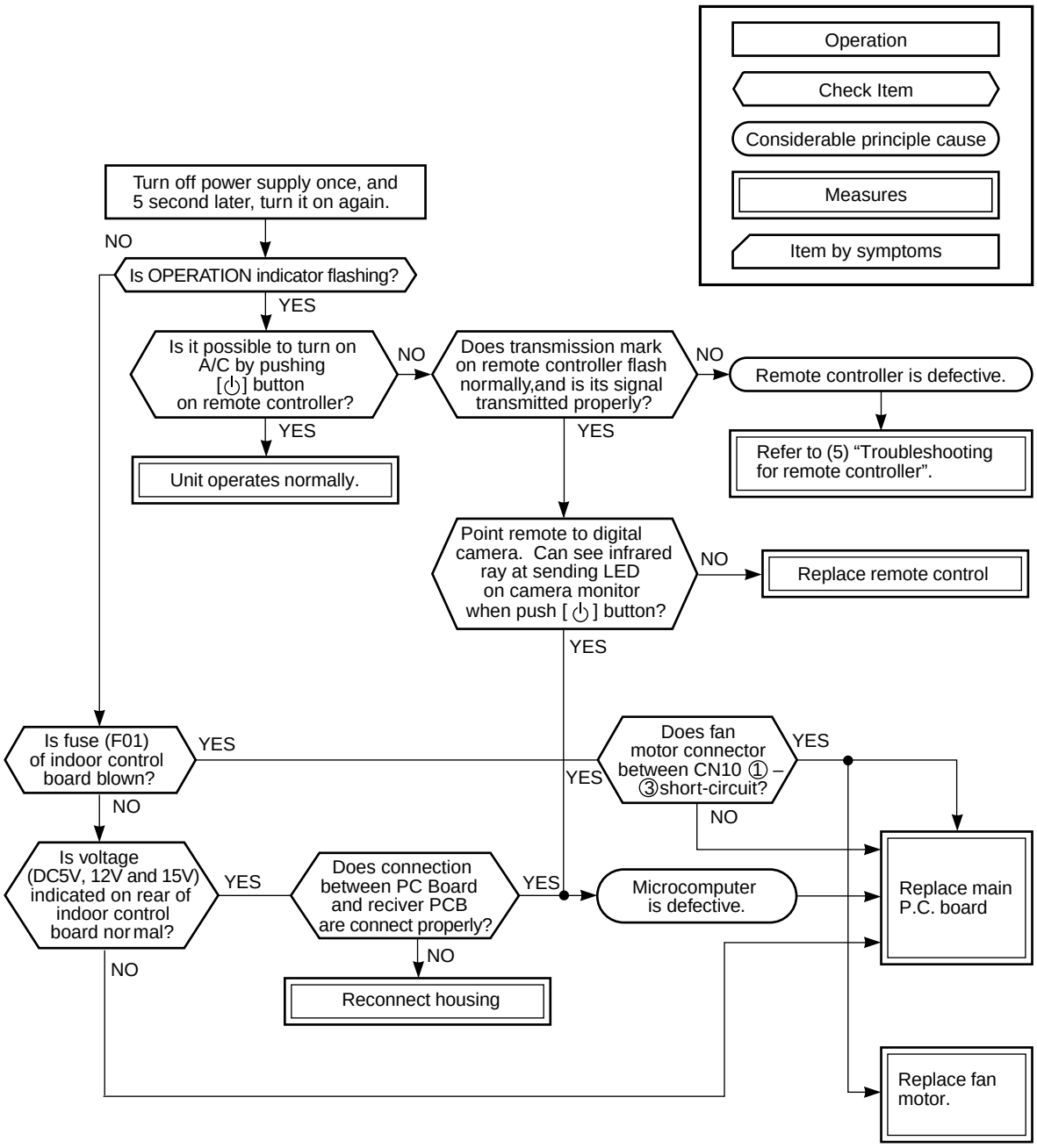
11-5-1. Indoor unit (Including remote controller)

(1) Indoor unit is not operated.

(RAS-09EKV-UL)

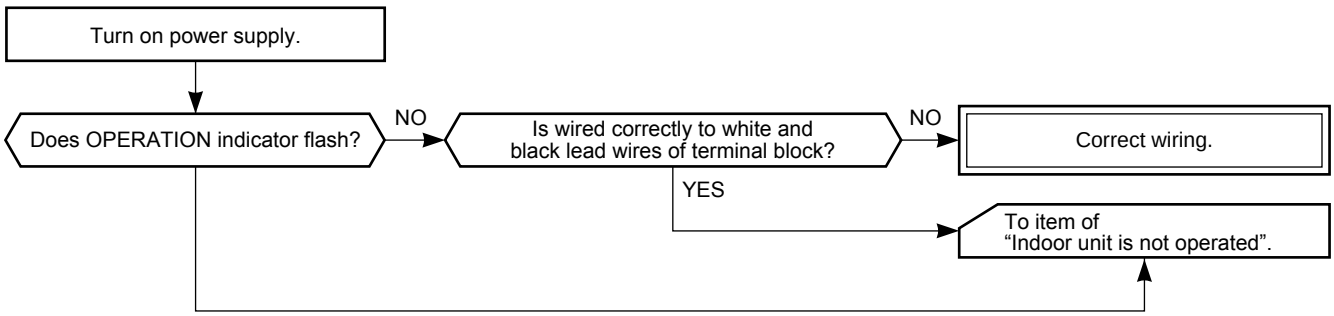

Turn off power supply once, and 5 second later, turn it on again.
Is OPERATION lamp blinking?
NO
YES
Is it possible to turn on Indoor unit by pressing [⏻] button on remote control?
NO
YES
Does transmission mark on remote control flash normally, and is its signal transmitted properly?
NO
YES
Remote control is defective.
Refer to (5) "Troubleshooting for Remote Control."
Unit operates normally.
Is fuse (F01) of indoor control board blown?
YES
NO
Parts (DB01,C27,T01 and IC02) are defective.
Is voltage (DC 12V or 5V) indicated on indoor control board normal?
YES
NO
Does Connection between main PC Board and display PCB are connect properly ?
YES
NO
Reconnect housing
Microcomputer is defective.
Replace main P.C. board.
Operation
Check item
Conceivable principle cause
Measure
Item by symptoms

(RAS-12EKV-UL)


Operation
Check Item
Considerable principle cause
Measures
Item by symptoms
Turn off power supply once, and 5 second later, turn it on again.
NO
Is OPERATION indicator flashing?
YES
Is it possible to turn on A/C by pushing [⏻] button on remote controller?
NO
Does transmission mark on remote controller flash normally,and is its signal transmitted properly?
NO
Remote controller is defective.
YES
Refer to (5) "Troubleshooting for remote controller".
YES
Unit operates normally.
Point remote to digital camera. Can see infrared ray at sending LED on camera monitor when push [⏻] button?
NO
Replace remote control
YES
Is fuse (F01) of indoor control board blown?
YES
Does fan motor connector between CN10 ① – ③short-circuit?
YES
YES
NO
NO
Is voltage (DC5V, 12V and 15V) indicated on rear of indoor control board nor mal?
YES
Does connection between PC Board and reciver PCB are connect properly?
YES
Microcomputer is defective.
Replace main P.C. board
NO
NO
Reconnect housing
Replace fan motor.

(2) Operation is not turned on though Indoor P.C. board is replaced

<Confirmation procedure>


Turn on power supply.
Does OPERATION indicator flash?
NO
Is wired correctly to white and black lead wires of terminal block?
NO
Correct wiring.
YES
To item of "Indoor unit is not operated".

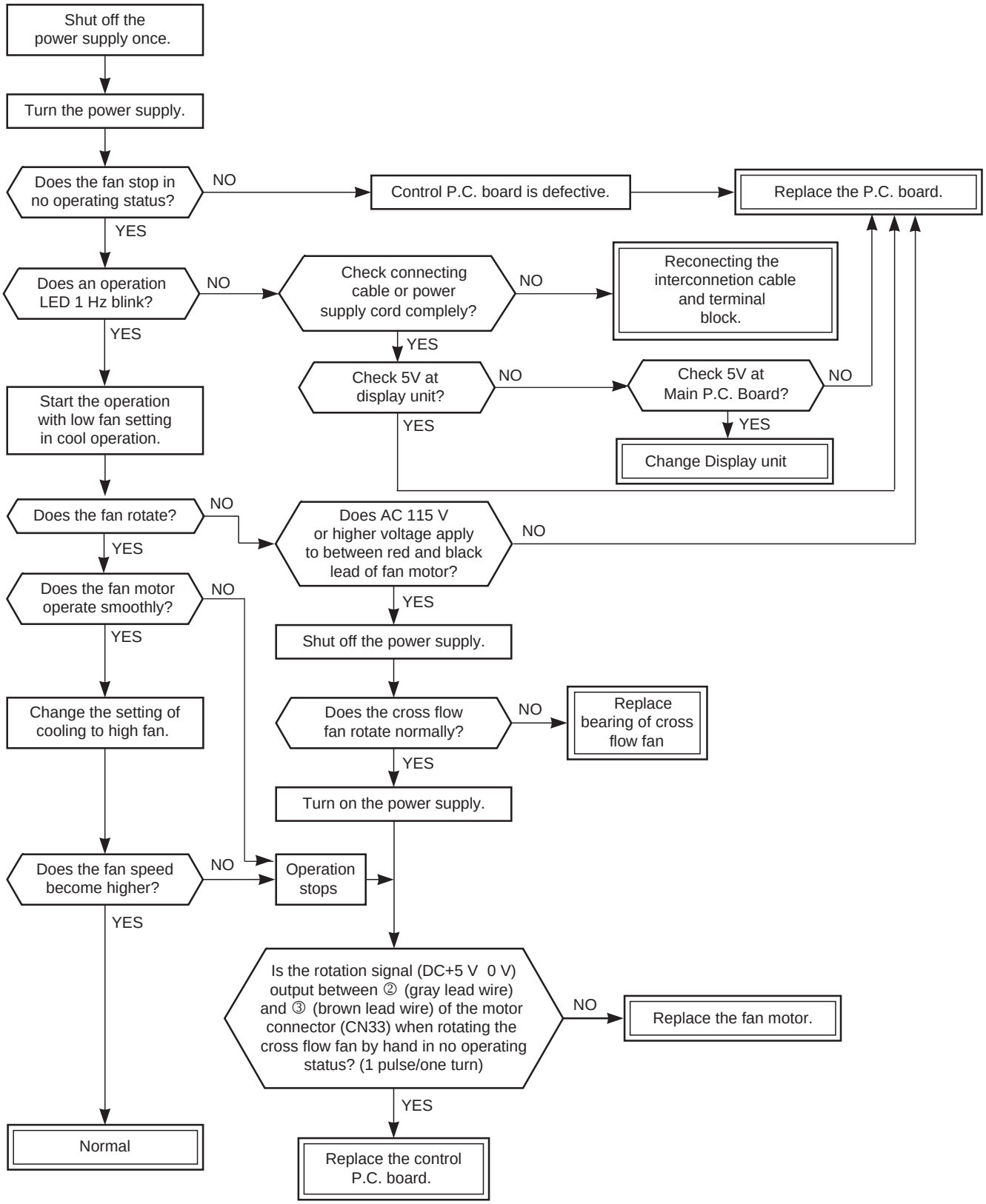
(3) Only the indoor motor fan does not operate

<Primary check>

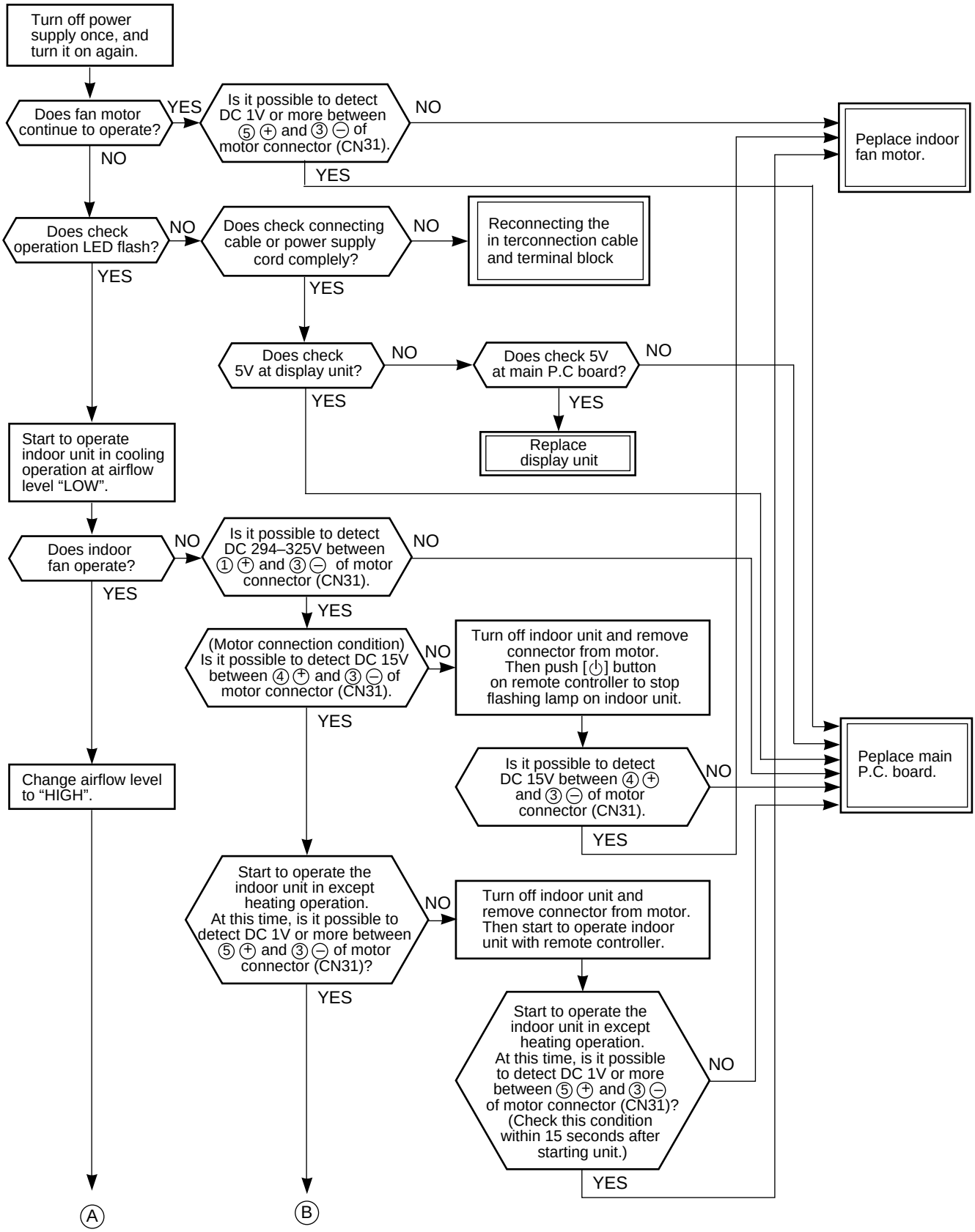
1. Is it possible to detect the power supply voltage (AC208–230V) between Ⓛ1 and Ⓛ2 on the terminal block?
2. Does the indoor fan motor operate in cooling operation?
   (In heating operation, the indoor fan motor does not operate for approximately 10 minutes after it is turned on, to prevent a cold air from blowing in.)

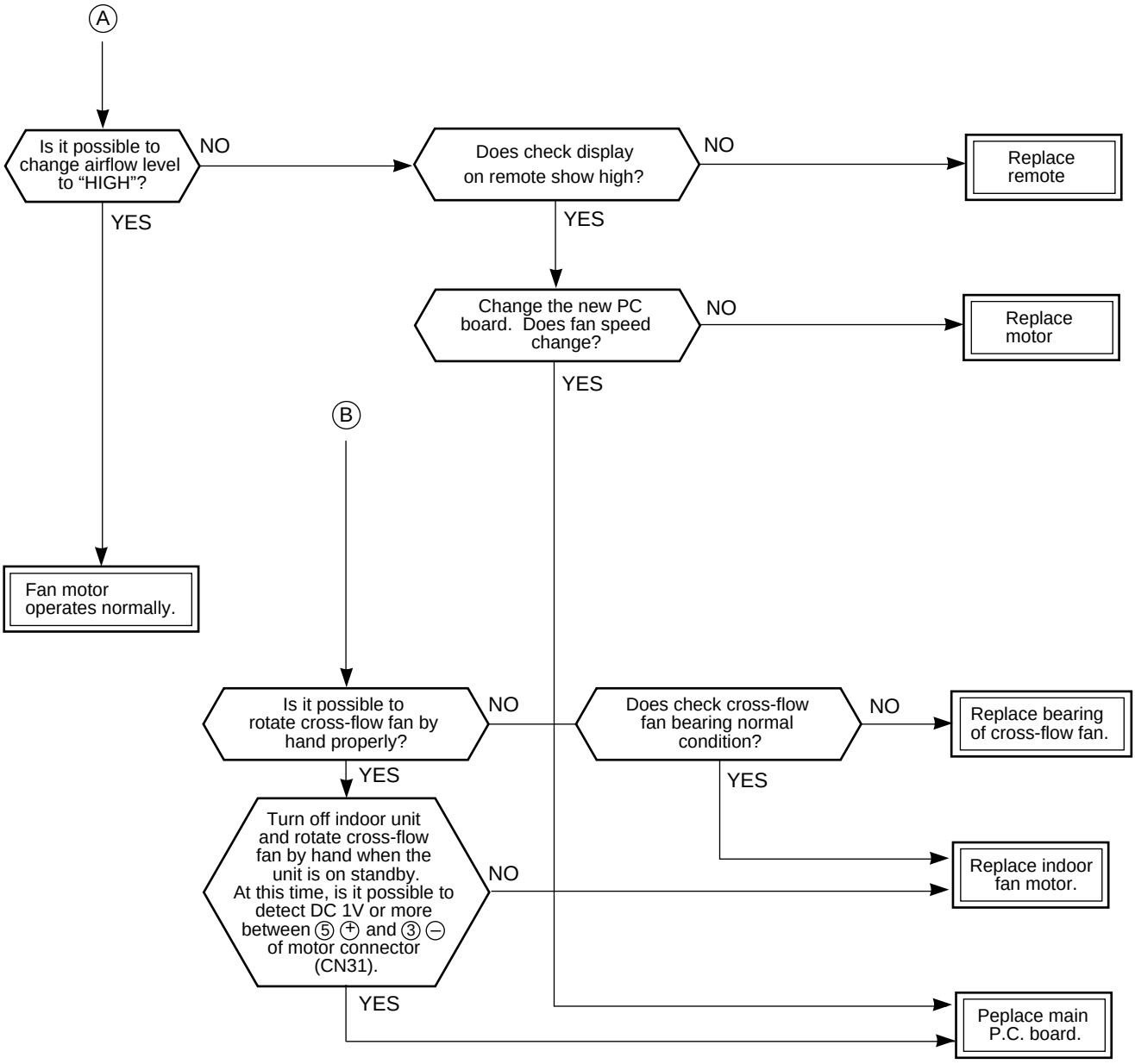
(RAS-09EKV-UL)

<Check procedure>


Shut off the power supply once.
Turn the power supply.
Does the fan stop in no operating status?
NO
Control P.C. board is defective.
Replace the P.C. board.
YES
Does an operation LED 1 Hz blink?
NO
Check connecting cable or power supply cord complely?
NO
Reconecting the interconnetion cable and terminal block.
YES
YES
Check 5V at display unit?
NO
Check 5V at Main P.C. Board?
NO
YES
YES
Change Display unit
Start the operation with low fan setting in cool operation.
Does the fan rotate?
NO
Does AC 115 V or higher voltage apply to between red and black lead of fan motor?
NO
YES
Does the fan motor operate smoothly?
NO
YES
Shut off the power supply.
Change the setting of cooling to high fan.
Does the cross flow fan rotate normally?
NO
Replace bearing of cross flow fan
YES
Turn on the power supply.
Does the fan speed become higher?
NO
Operation stops
YES
Is the rotation signal (DC+5 V 0 V) output between ② (gray lead wire) and ③ (brown lead wire) of the motor connector (CN33) when rotating the cross flow fan by hand in no operating status? (1 pulse/one turn)
NO
Replace the fan motor.
YES
Normal
Replace the control P.C. board.

(RAS-12EKV-UL)


Turn off power supply once, and turn it on again.
Does fan motor continue to operate?
YES
NO
Is it possible to detect DC 1V or more between ⑤ ⊕ and ③ ⊖ of motor connector (CN31).
NO
YES
Peplace indoor fan motor.
Does check operation LED flash?
NO
YES
Does check connecting cable or power supply cord complely?
NO
YES
Reconnecting the in terconnection cable and terminal block
Does check 5V at display unit?
NO
YES
Does check 5V at main P.C board?
NO
YES
Replace display unit
Start to operate indoor unit in cooling operation at airflow level “LOW”.
Does indoor fan operate?
NO
YES
Is it possible to detect DC 294–325V between ① ⊕ and ③ ⊖ of motor connector (CN31).
NO
YES
(Motor connection condition) Is it possible to detect DC 15V between ④ ⊕ and ③ ⊖ of motor connector (CN31).
NO
YES
Turn off indoor unit and remove connector from motor. Then push [⏻] button on remote controller to stop flashing lamp on indoor unit.
Is it possible to detect DC 15V between ④ ⊕ and ③ ⊖ of motor connector (CN31).
NO
YES
Peplace main P.C. board.
Change airflow level to “HIGH”.
Start to operate the indoor unit in except heating operation. At this time, is it possible to detect DC 1V or more between ⑤ ⊕ and ③ ⊖ of motor connector (CN31)?
NO
YES
Turn off indoor unit and remove connector from motor. Then start to operate indoor unit with remote controller.
Start to operate the indoor unit in except heating operation. At this time, is it possible to detect DC 1V or more between ⑤ ⊕ and ③ ⊖ of motor connector (CN31)? (Check this condition within 15 seconds after starting unit.)
NO
YES
Ⓐ
Ⓑ


A
Is it possible to change airflow level to “HIGH”?
NO
YES
Does check display on remote show high?
NO
Replace remote
YES
Change the new PC board. Does fan speed change?
NO
Replace motor
YES
Fan motor operates normally.
B
Is it possible to rotate cross-flow fan by hand properly?
NO
YES
Does check cross-flow fan bearing normal condition?
NO
Replace bearing of cross-flow fan.
YES
Turn off indoor unit and rotate cross-flow fan by hand when the unit is on standby. At this time, is it possible to detect DC 1V or more between ⑤ ⊕ and ③ ⊖ of motor connector (CN31).
NO
Replace indoor fan motor.
YES
Peplace main P.C. board.

(4) Indoor fan motor automatically starts to rotate by turning on power supply

(For AC fan motor in RAS-09EKV-UL)

<Cause>

AC motor is only coil and Hall-IC inside packing all driving control or circuit locate on a main PC Board.

<Inspection procedure>

1. Turn on breaker.
2. After Fan motor operate, off A/C by remote controller.
3. Turn off breaker for a while, then turn it ON.
   3.1. If fan motor not operate, it means an unit in Auto-restart operation. (see more detail in P. 45-46)
   3.2. If Fan motor still operate, means P.C Board mal-function. Replace P.C Board.

(For DC fan motor in RAS-12EKV-UL)

<Cause>

The IC is built in the indoor fan motor. Therefore the P.C. board is also mounted to inside of the motor.

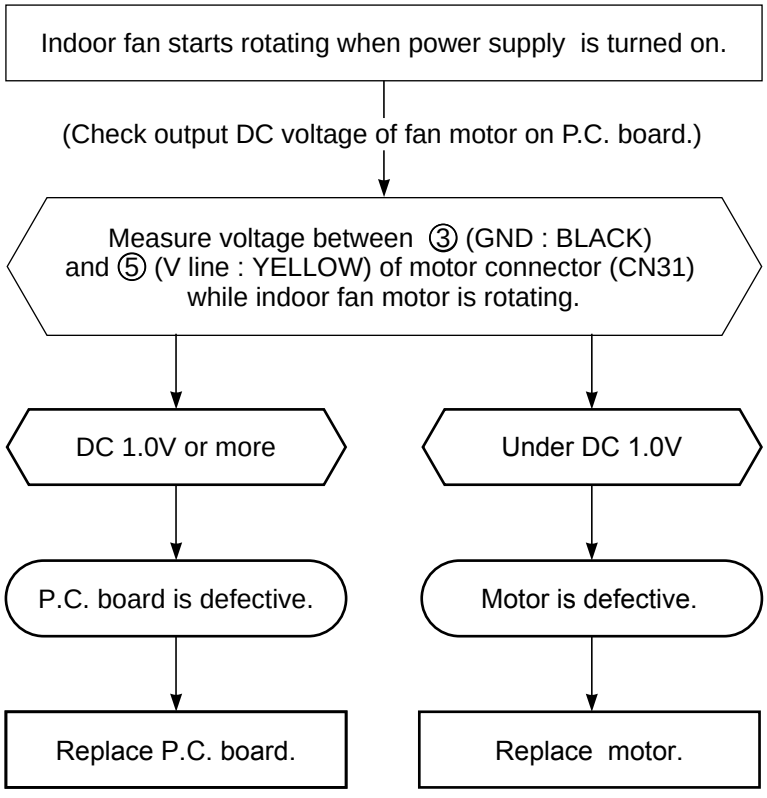
If the P.C. board is soldered imperfectly or the IC is defective, the fan motor may automatically rotate by turning on power supply.

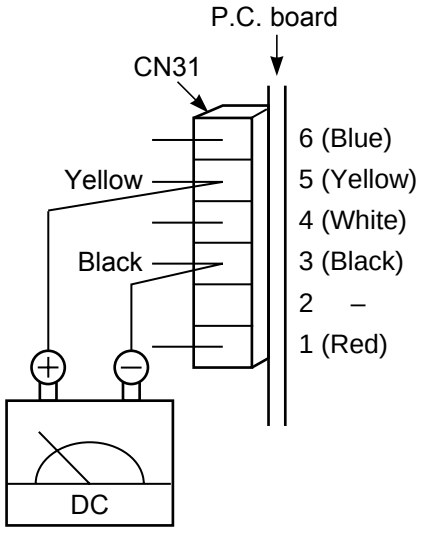
<Inspection procedure>

1. Turn on breaker.
2. After Fan motor operate, off A/C by remote controller.
3. Turn off breaker for a while, then turn it ON.
   3.1. If fan motor not operate, it means an unit in Auto-restart operation. (see more detail in P. 44-45)
   3.2. If Fan motor still operate, follow the below.
      3.2.1. Remove the grille.
      3.2.2. Remove the cover terminal by release one screw.
      3.2.3. Check DC voltage with CN31 connector while the fan motor is rotating.

NOTE :

- Do not disconnect the connector while the fan motor is rotating.
- Use a thin test rod.

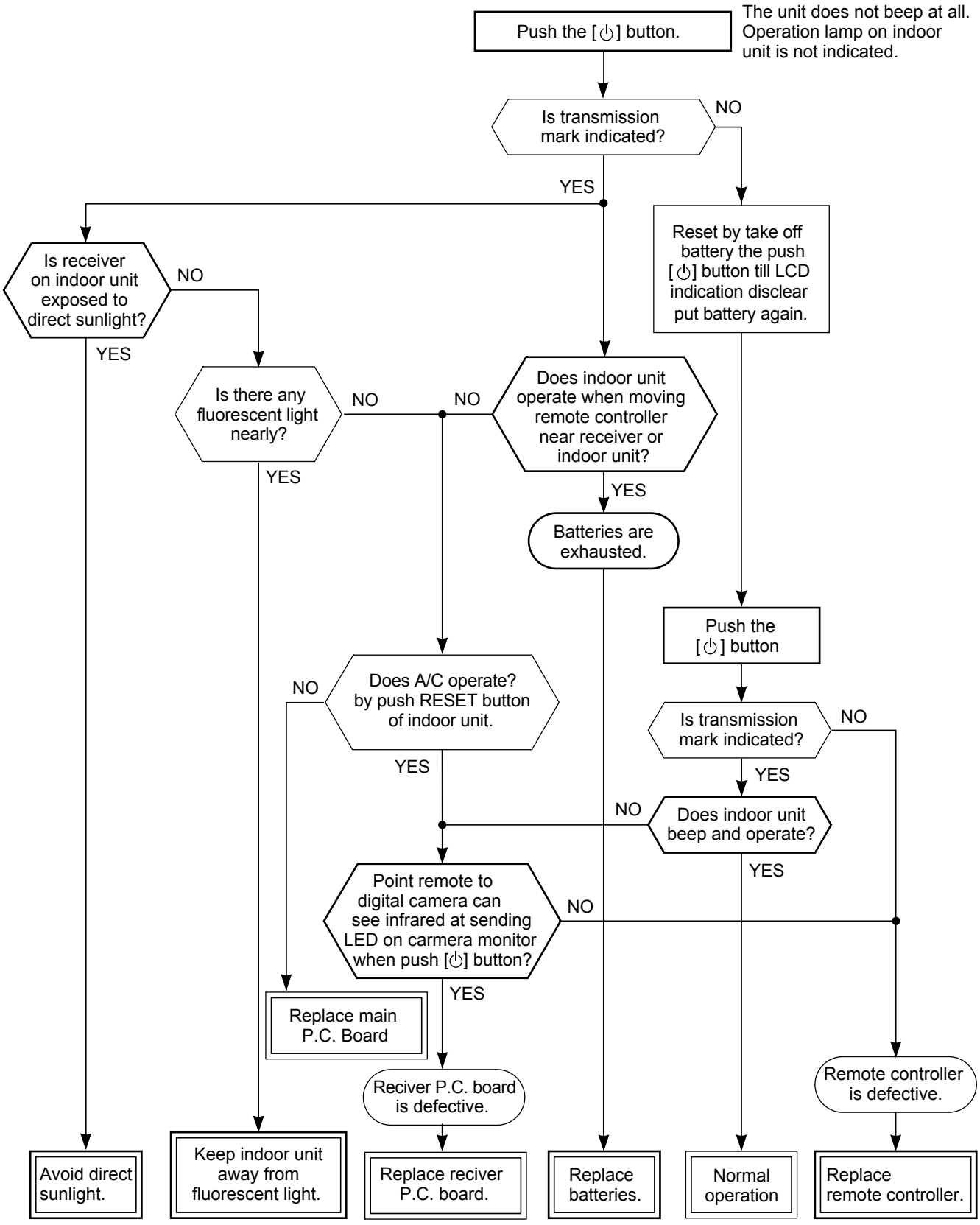

Indoor fan starts rotating when power supply is turned on.
(Check output DC voltage of fan motor on P.C. board.)
Measure voltage between ③ (GND : BLACK) and ⑤ (V line : YELLOW) of motor connector (CN31) while indoor fan motor is rotating.
DC 1.0V or more
Under DC 1.0V
P.C. board is defective.
Motor is defective.
Replace P.C. board.
Replace motor.



(5) Troubleshooting for remote controller

<Primary check>

Check that A or B selected on the main unit is matched with A or B selected on the remote controller.


Push the [⏻] button.
The unit does not beep at all. Operation lamp on indoor unit is not indicated.
Is transmission mark indicated?
NO
YES
Reset by take off battery the push [⏻] button till LCD indication disclear put battery again.
Is receiver on indoor unit exposed to direct sunlight?
NO
YES
Is there any fluorescent light nearly?
NO
YES
NO
Does indoor unit operate when moving remote controller near receiver or indoor unit?
YES
Batteries are exhausted.
Push the [⏻] button
Does A/C operate? by push RESET button of indoor unit.
NO
YES
Is transmission mark indicated?
NO
YES
NO
Does indoor unit beep and operate?
YES
Point remote to digital camera can see infrared at sending LED on carmera monitor when push [⏻] button?
NO
YES
Replace main P.C. Board
Reciver P.C. board is defective.
Remote controller is defective.
Avoid direct sunlight.
Keep indoor unit away from fluorescent light.
Replace reciver P.C. board.
Replace batteries.
Normal operation
Replace remote controller.

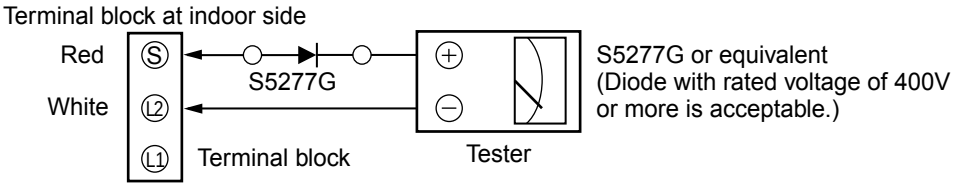
11-5-2. Wiring Failure (Interconnecting and Serial Signal Wire)

(1) Outdoor unit does not operate

1) Is the voltage between Ⓛ2 and Ⓢ of the indoor terminal block varied?
Confirm that transmission from indoor unit to outdoor unit is correctly performed based upon the following diagram.

NOTE:

- Measurement should be performed 2 minutes and 30 seconds after starting of the operation.
- Be sure to prepare a diode for judgment.

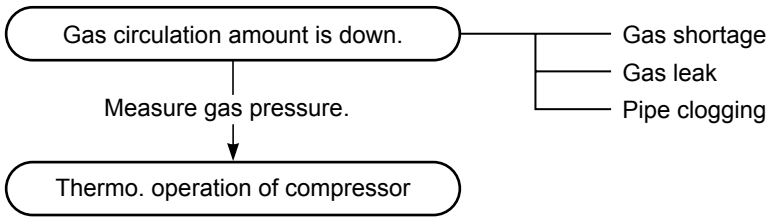


Normal time : Voltage swings between DC15 and 60V. .....Inverter Assembly check (**11-5-1.**)
Abnormal time : Voltage does not vary.

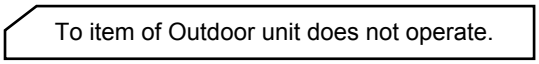
(2) Outdoor unit stops in a little while after operation started

<Check procedure> Select phenomena described below.

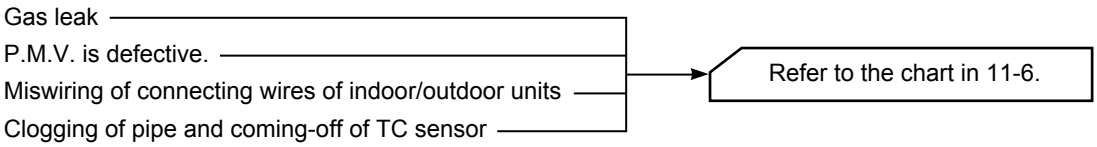
1) The outdoor unit stops 10 to 20 minutes after operation started, and 10 minutes or more are required to restart the unit.



2) If the unit stops once, it does not operate until the power will be turned on again.

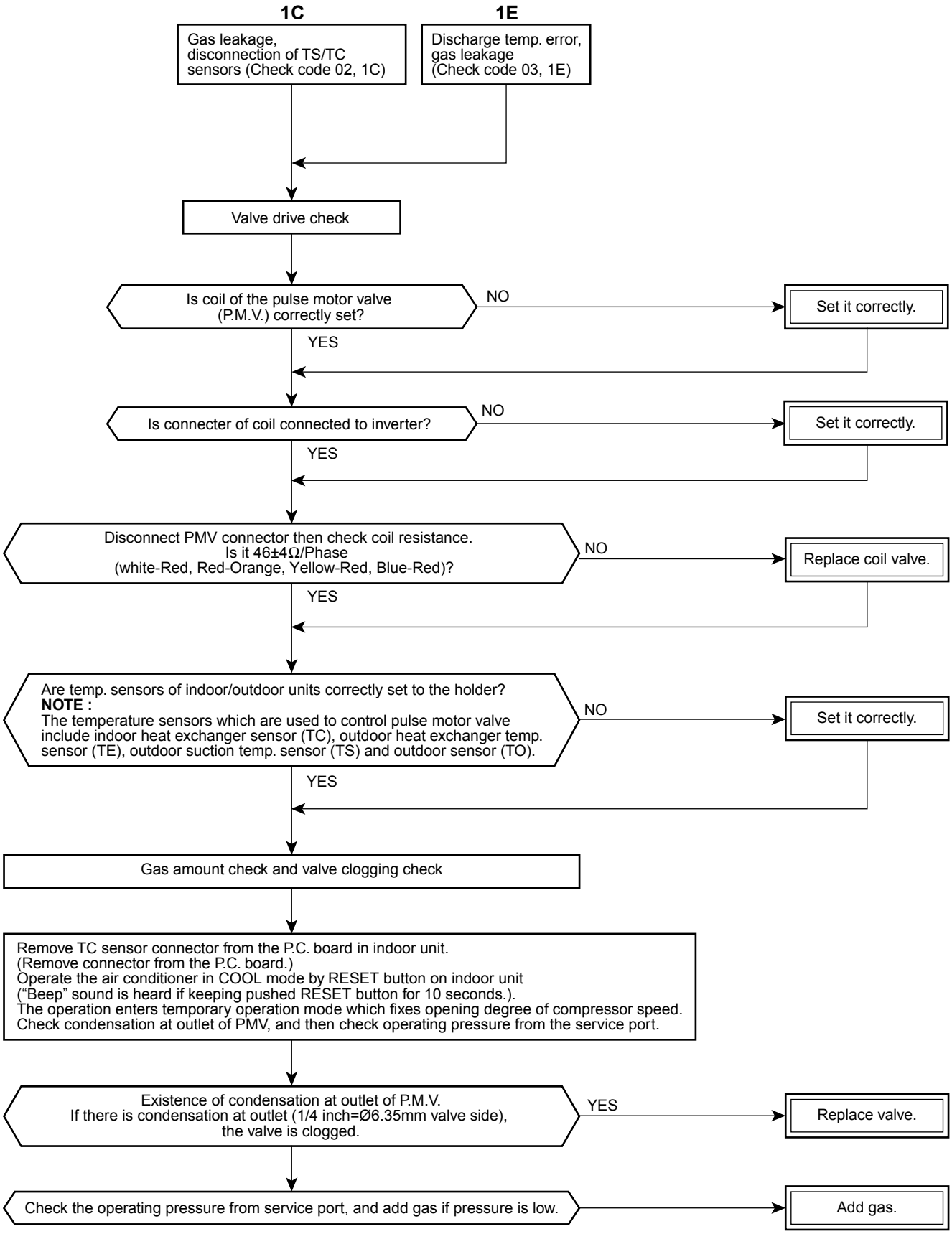


3) The outdoor unit stops 10 minutes to 1 hour after operation started, and an alarm is displayed. (Discharge temp. error check code 03, 1E Sensor temp. error check code 02, 1C)

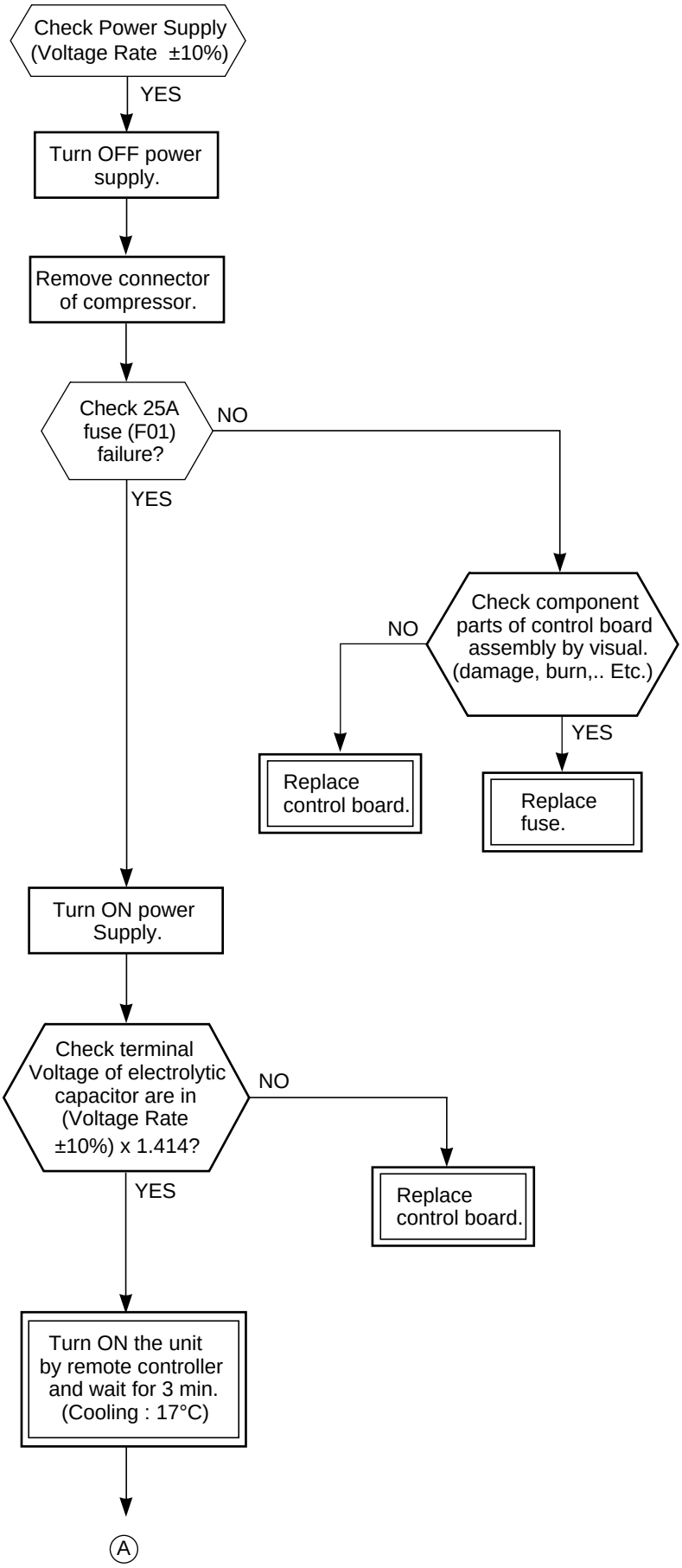

Gas leak
P.M.V. is defective.
Miswiring of connecting wires of indoor/outdoor units
Clogging of pipe and coming-off of TC sensor
Refer to the chart in 11-6.

11-6. Check Code 1C (Miswiring in indoor/outdoor units) and 1E

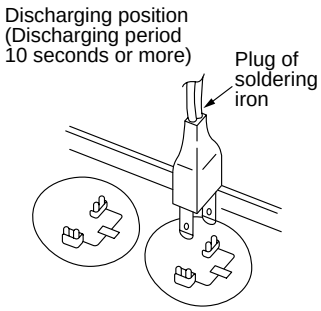
<Check procedure>

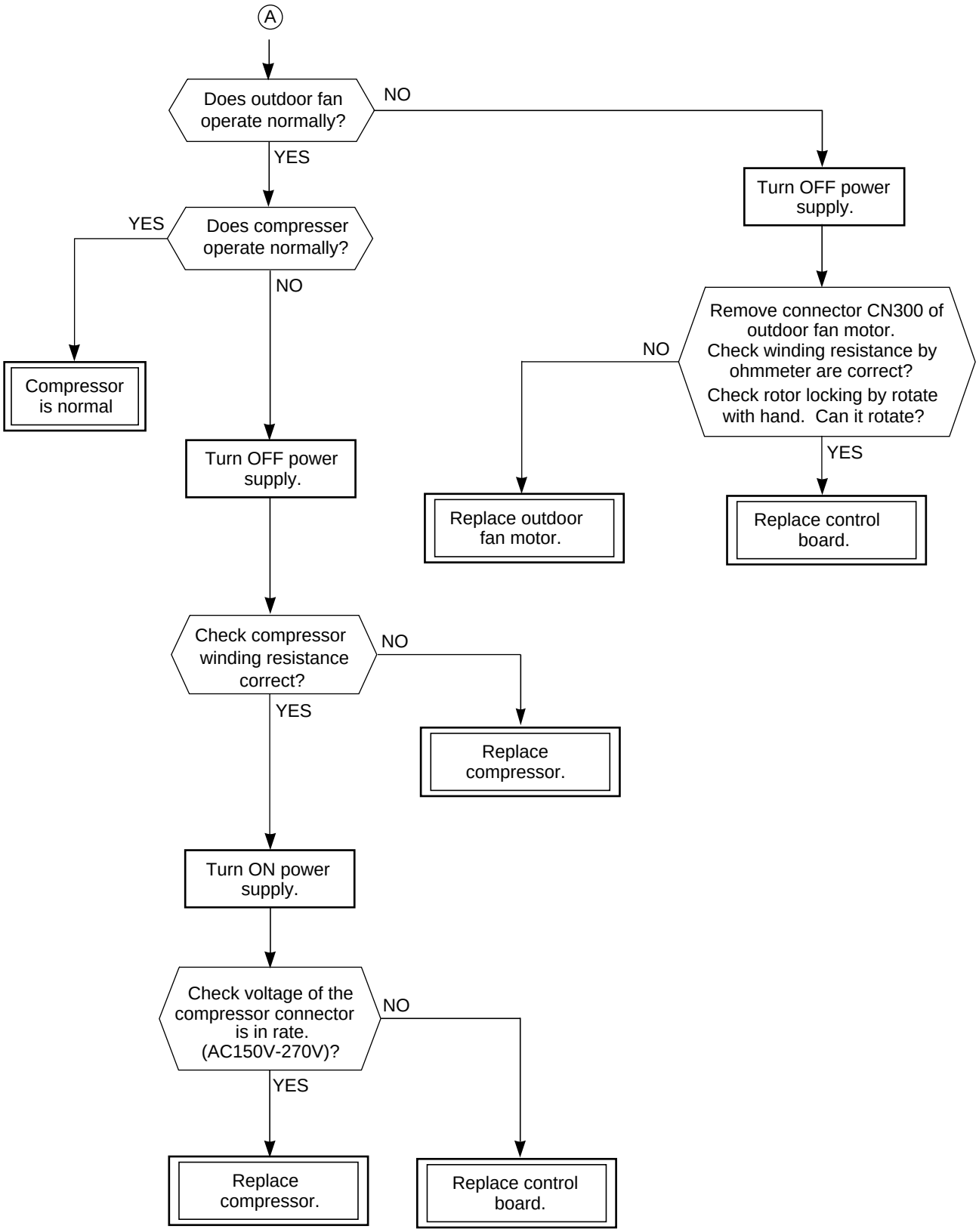

1C
1E
Gas leakage, disconnection of TS/TC sensors (Check code 02, 1C)
Discharge temp. error, gas leakage (Check code 03, 1E)
Valve drive check
Is coil of the pulse motor valve (P.M.V.) correctly set?
NO
Set it correctly.
YES
Is connecter of coil connected to inverter?
NO
Set it correctly.
YES
Disconnect PMV connector then check coil resistance. Is it 46±4Ω/Phase (white-Red, Red-Orange, Yellow-Red, Blue-Red)?
NO
Replace coil valve.
YES
Are temp. sensors of indoor/outdoor units correctly set to the holder?
NOTE :
The temperature sensors which are used to control pulse motor valve include indoor heat exchanger sensor (TC), outdoor heat exchanger temp. sensor (TE), outdoor suction temp. sensor (TS) and outdoor sensor (TO).
NO
Set it correctly.
YES
Gas amount check and valve clogging check
Remove TC sensor connector from the P.C. board in indoor unit.
(Remove connector from the P.C. board.)
Operate the air conditioner in COOL mode by RESET button on indoor unit
(“Beep” sound is heard if keeping pushed RESET button for 10 seconds.).
The operation enters temporary operation mode which fixes opening degree of compressor speed.
Check condensation at outlet of PMV, and then check operating pressure from the service port.
Existence of condensation at outlet of P.M.V.
If there is condensation at outlet (1/4 inch=Ø6.35mm valve side), the valve is clogged.
YES
Replace valve.
Check the operating pressure from service port, and add gas if pressure is low.
Add gas.

11-7. How to Diagnose Trouble in Outdoor Unit


Check Power Supply (Voltage Rate ±10%)
YES
Turn OFF power supply.
Remove connector of compressor.
Check 25A fuse (F01) failure?
NO
YES
Check component parts of control board assembly by visual. (damage, burn,.. Etc.)
NO
YES
Replace control board.
Replace fuse.
Turn ON power Supply.
Check terminal Voltage of electrolytic capacitor are in (Voltage Rate ±10%) x 1.414?
NO
YES
Replace control board.
Turn ON the unit by remote controller and wait for 3 min. (Cooling : 17°C)
Ⓐ

- Connect discharge resistance (approx. 100Ω, 40W) or soldering iron (plug) between +, – terminals of the electrolytic capacitor (500μF) of C14 (with printed CAUTION HIGH VOLTAGE) on P.C. board.




A
Does outdoor fan operate normally?
NO
YES
Turn OFF power supply.
Does compresser operate normally?
YES
NO
Remove connector CN300 of outdoor fan motor.
Check winding resistance by ohmmeter are correct?
Check rotor locking by rotate with hand. Can it rotate?
NO
YES
Compressor is normal
Turn OFF power supply.
Replace outdoor fan motor.
Replace control board.
Check compressor winding resistance correct?
NO
YES
Replace compressor.
Turn ON power supply.
Check voltage of the compressor connector is in rate. (AC150V-270V)?
NO
YES
Replace compressor.
Replace control board.

11-8. How to Check Simply the Main Parts

11-8-1. How to check the P.C. board (Indoor unit)

(1) Operating precautions

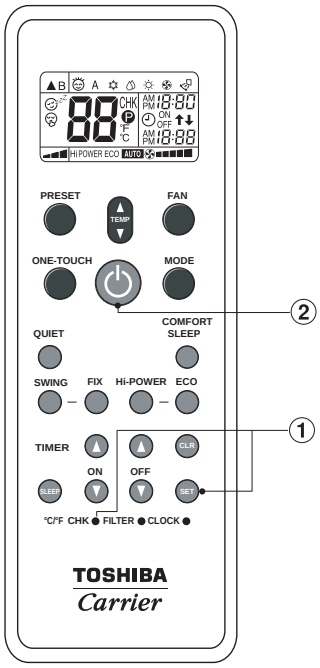
1) When removing the front panel or the P.C. board, be sure to shut off the power supply breaker.
2) When removing the P.C. board, hold the edge of the P.C. board and do not apply force to the parts.
3) When connecting or disconnecting the connectors on the P.C. board, hold the whole housing. Do not pull at the lead wire.

(2) Inspection procedures

1) When a P.C. board is judged to be defective, check for disconnection, burning, or discoloration of the copper foil pattern or this P.C. board.
2) The P.C. board consists of the following 2 parts
   a. Main P.C. board part:
   DC power supply circuit (5 V, 12 V),
   Indoor fan motor control circuit, CPU and peripheral circuits, buzzer, and Driving circuit of louver.
   b. Indication unit of infrared ray receiving Infrared ray receiving circuit, LED:

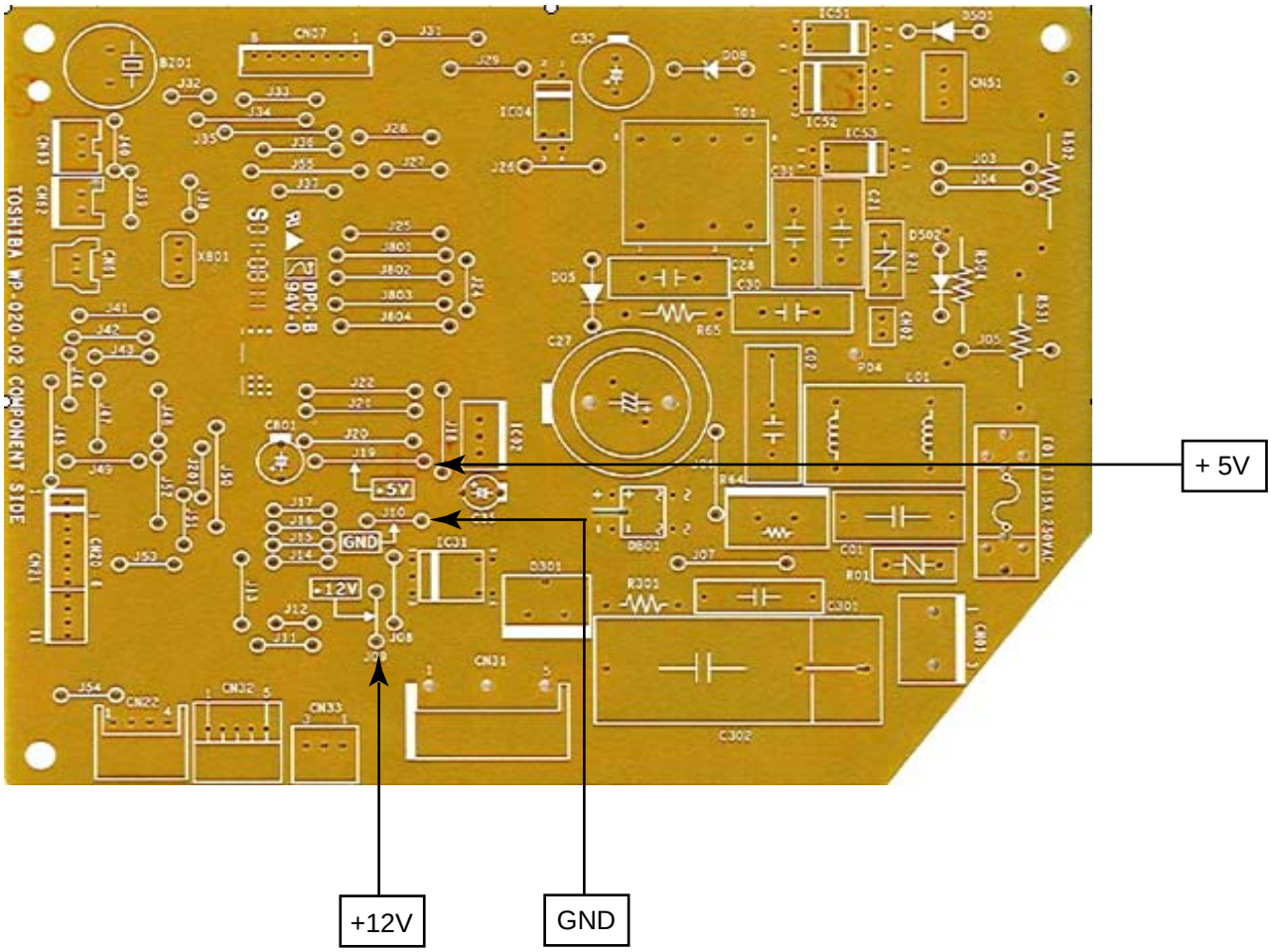
11-8-2. How to shorten time for start the compressor.

1. Turn on remote.
2. Setting requirment operation.
3. Push off remote.
4. Press [SET] button while pressing [CHECK] button with a tip of a pencil.
5. Then press [⏻] button to transmit the signal to the indoor unit.

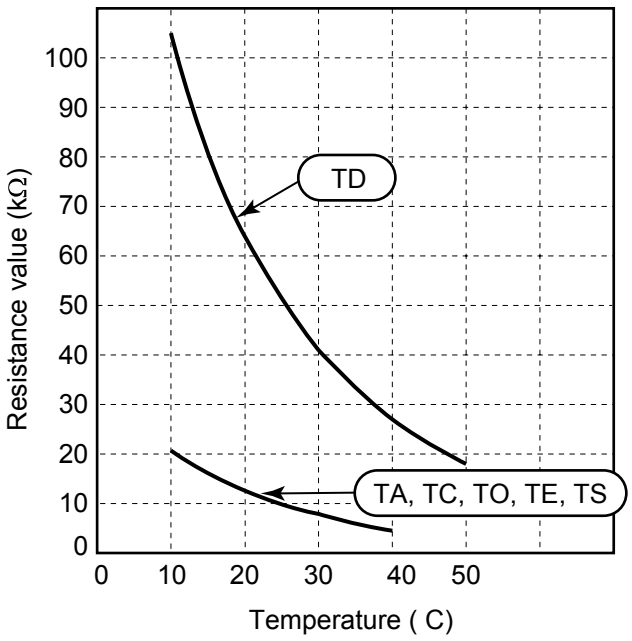


This setting helps to shortern a compressor waiting period when operate cool, heat or dry mode.
A compressor suddenly starts one order of Remote controller is received.

11-8-2. P .C . Board Layout
(RAS-09EKV-UL)

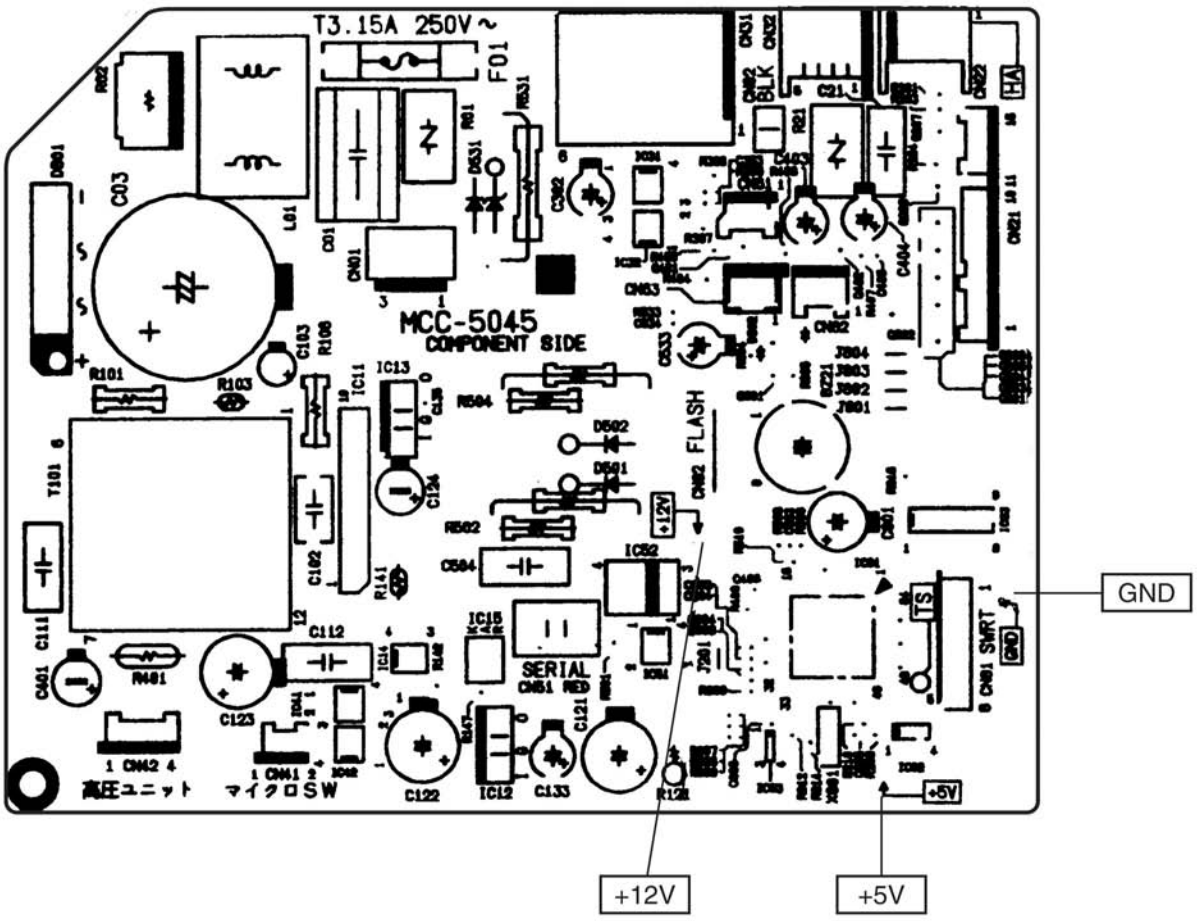


[1] Sensor characteristic table

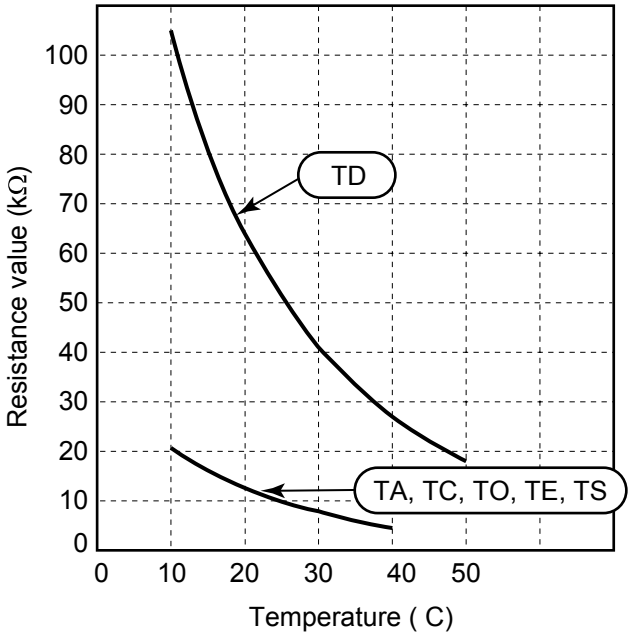


TD : Discharge temp. sensor
TA : Room temp. sensor
TC : Heat exchanger temp. sensor
TO : Outdoor temp. sensor
TE : Outdoor heat exchanger temp. sensor
TS : Suction temp. sensor

(RAS-12EKV-UL)

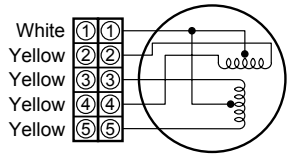


[1] Sensor characteristic table



TD : Discharge temp. sensor
TA : Room temp. sensor
TC : Heat exchanger temp. sensor
TO : Outdoor temp. sensor
TE : Outdoor heat exchanger temp. sensor
TS : Suction temp. sensor

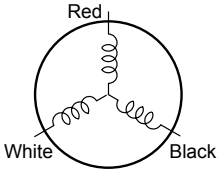
11-8-3. Indoor Unit (Other Parts)

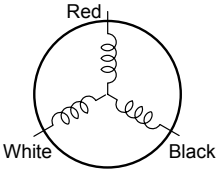
<table>
<tr><th>No.</th><th>Part name</th><th>Checking procedure</th></tr>
<tr><td>1</td><td>Room temp. (TA) sensor
Heat exchanger (TC) sensor</td><td>Disconnect the connector and measure the resistance value with tester.
(Normal temp.)
<table>
<tr><th>Sensor \ Temperature</th><th>10°C</th><th>20°C</th><th>25°C</th><th>30°C</th><th>40°C</th></tr>
<tr><td>TA, TC (kΩ)</td><td>20.7</td><td>12.6</td><td>10.0</td><td>7.9</td><td>4.5</td></tr>
</table></td></tr>
<tr><td>2</td><td>Remote controller</td><td>Refer to 11-5-1. (5).</td></tr>
<tr><td>3</td><td>Louver motor
24BYJ48-HTP</td><td>Measure the resistance value of each winding coil by using the tester.
(Under normal temp. 25°C)
 

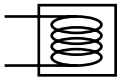
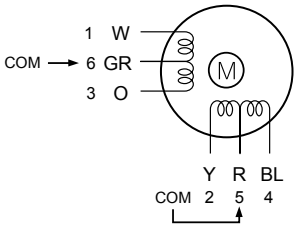
<table>
<tr><th>Position</th><th>Resistance value</th></tr>
<tr><td>1 to 2
1 to 3
1 to 4
1 to 5</td><td>250 ± 20Ω</td></tr>
</table></td></tr>
<tr><td>4</td><td>Indoor fan motor</td><td>Refer to 11-5-1. (3) and (4).</td></tr>
</table>

11-8-4. OutdoorUnit

<table>
<tr><th>No.</th><th>Part name</th><th>Checking procedure</th></tr>
<tr><td>1</td><td>Compressor
(Model : DA111A1F-20F2)
RAS-12EA Series

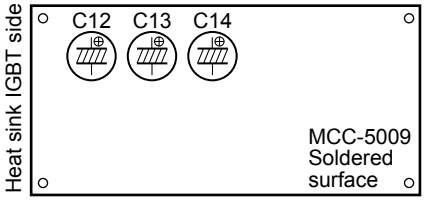
(Model : DA89X1C-23FZ2)
RAS-09EA Series</td><td>Measure the resistance value of each winding by using the tester.
 

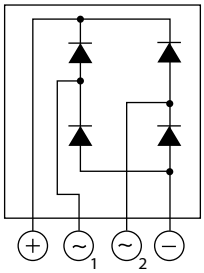
<table>
<tr><th rowspan="2">Position</th><th colspan="2">Resistance value</th></tr>
<tr><th>DA111A1F-20F1</th><th>DA89X1C-1F-23FZ</th></tr>
<tr><td>Red - White</td><td rowspan="3">0.88 to 0.98Ω</td><td rowspan="3">1.04 to 1.16Ω</td></tr>
<tr><td>White - Black</td></tr>
<tr><td>Black - Red</td></tr>
</table>
at 20ºC</td></tr>
<tr><td>2</td><td>Outdoor fan motor
(Model : ICF-340UA0-2)</td><td>Measure the resistance value of winding by using the tester.
 

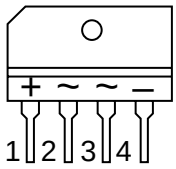
<table>
<tr><th>Position</th><th>Resistance value</th></tr>
<tr><td>Red - White</td><td>20 to 22Ω</td></tr>
<tr><td>White - Black</td><td>20 to 22Ω</td></tr>
<tr><td>Black- Red</td><td>20 to 22Ω</td></tr>
</table>
at 20ºC</td></tr>
<tr><td>3</td><td>4-way valve coil
(Model : STF-01U8Z)</td><td>Measure the resistance value of winding by using the tester.
 
<table>
<tr><th>Resistance value</th></tr>
<tr><td>1435 ± 144Ω</td></tr>
</table>
at 20°C</td></tr>
<tr><td>4</td><td>Pulse motor valve coil
(Model : CAM-MD12TCTH-4)</td><td>Measure the resistance value of winding by using the tester.
 

<table>
<tr><th>Position</th><th>Resistance value</th></tr>
<tr><td>Gray - White</td><td>42 to 50Ω</td></tr>
<tr><td>Gray - Orange</td><td>42 to 50Ω</td></tr>
<tr><td>Red- Yellow</td><td>42 to 50Ω</td></tr>
<tr><td>Red- Blue</td><td>42 to 50Ω</td></tr>
</table>
at 20°C</td></tr>
<tr><td>5</td><td>Outdoor temperature sensor (TO), discharge temperature sensor (TD), suction temperature sensor (TS), outdoor heat exchanger temperature sensor (TE)</td><td>Disconnect the connector, and measure resistance value with the tester.
(Normal temperature)
<table>
<tr><th>Sensor \ Temperature</th><th>10°C</th><th>20°C</th><th>25°C</th><th>30°C</th><th>40°C</th><th>50°C</th></tr>
<tr><td>TD (kΩ)</td><td>100</td><td>64</td><td>50</td><td>41</td><td>27</td><td>18</td></tr>
<tr><td>TO,TS,TE (kΩ)</td><td>20.7</td><td>12.6</td><td>10.0</td><td>7.9</td><td>4.5</td><td>—</td></tr>
</table></td></tr>
</table>

11-8-5. Checking Method for Each Part

<table>
<tr><th>No.</th><th>Part name</th><th>Checking procedure</th></tr>
<tr><td>1</td><td>Electrolytic capacitor
(For boost, smoothing)</td><td>1. Turn OFF the power supply breaker.
2. Discharge all three capacitors completely.
3. Check that safety valve at the bottom of capacitor is not broken.
4. Check that vessel is not swollen or exploded.
5. Check that electrolytic liquid does not blow off.
6. Check that the normal charging characteristics are shown in continuity test by the tester.
 

<table><tr><th>Case that product is good</th></tr><tr><td>Pointer swings once, and returns slowly. When performing test once again under another polarity, the pointer should return.</td></tr></table>
C12, C13, C14 → 500μF</td></tr>
<tr><td>2</td><td>Diode block</td><td>1. Turn OFF the power supply breaker.
2. Discharge all three capacitors completely.
3 Check that the normal rectification characteristics are shown in continuity test by the tester.
 



(DB01)
Diode check
<table>
<tr><th colspan="2">Tester rod</th><th>Resistance value in good product</th></tr>
<tr><td>⊕</td><td>⊖</td><td rowspan="4">50kΩ or more
(0Ω in trouble)</td></tr>
<tr><td>~1</td><td rowspan="2">⊖</td></tr>
<tr><td>~2</td></tr>
<tr><td rowspan="2">⊕</td><td>~1</td></tr>
<tr><td>~2</td><td></td></tr>
</table></td></tr>
</table>

11-9. How to Simply Judge Whether Outdoor Fan Motor is Good or Bad

1. Symptom

- Outdoor fan motor does not rotate.
- Outdoor fan motor stops within several tens seconds though it started rotating.
- Outdoor fan motor rotates or does not rotate according to the position where the fan stopped, etc.

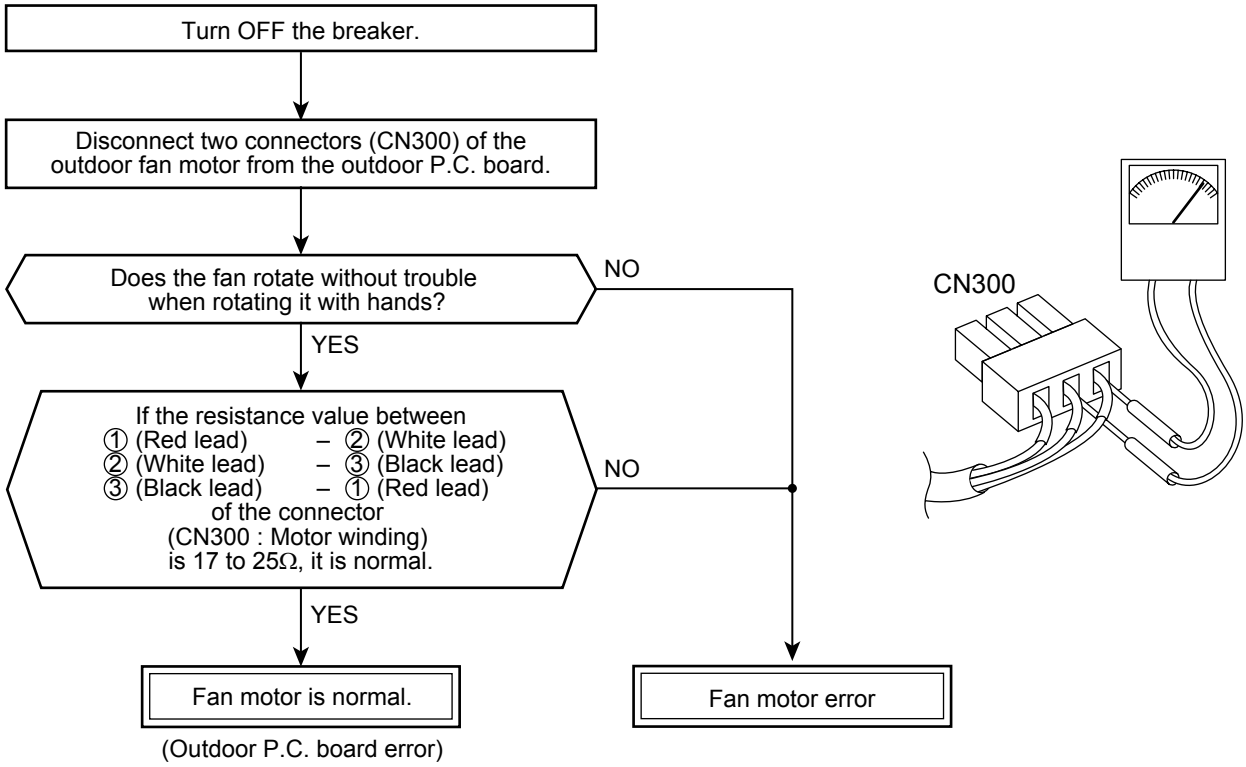
Remote controller check code “02 : Outdoor block, 1A : Outdoor fan drive system error”

2. Cause

The following causes are considered when the outdoor fan motor does not normally rotate.

1) Mechanical lock of the outdoor fan motor
2) Winding failure of the outdoor fan motor
3) Position-detect circuit failure inside of the outdoor fan motor
4) Motor drive circuit failure of the outdoor P.C. board

3. How to simply judge whether outdoor fan motor is good or bad


Turn OFF the breaker.
Disconnect two connectors (CN300) of the outdoor fan motor from the outdoor P.C. board.
Does the fan rotate without trouble when rotating it with hands?
NO
YES
If the resistance value between
① (Red lead) – ② (White lead)
② (White lead) – ③ (Black lead)
③ (Black lead) – ① (Red lead)
of the connector
(CN300 : Motor winding)
is 17 to 25Ω, it is normal.
NO
YES
Fan motor is normal.
(Outdoor P.C. board error)
Fan motor error
CN300

NOTE :

However, GND circuit error inside of the motor may be accepted in some cases when the above check is performed.

When the fan motor does not become normal even if P.C. board is replaced, replace the outdoor fan motor.

12. HOW TO REPLACE THE MAIN PARTS

WARNING

- Since high voltages pass through the electrical parts, turn off the power without fail before proceeding with the repairs.

  Electric shocks may occur if the power plug is not disconnected.
- After the repairs have been completed (after the front panel and cabinet have been installed), perform a test run, and check for smoking, unusual sounds and other abnormalities.

  If this check is omitted, a fire and/or electric shocks may occur.
  Before proceeding with the test run, install the front panel and cabinet.
- Ensure that the following steps are taken when doing repairs on the refrigerating cycle.
  1. Do not allow any naked flames in the surrounding area.
     If a gas stove or other appliance is being used, extinguish the flames before proceeding.

     If the flames are not extinguished, they may ignite any oil mixed with the refrigerant gas.
  2. Do not use welding equipment in an airtight room.

     Carbon monoxide poisoning may result if the room is not properly ventilated.
  3. Do not bring welding equipment near flammable objects.

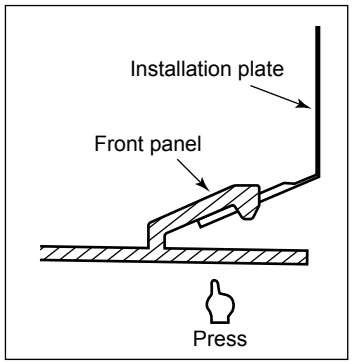
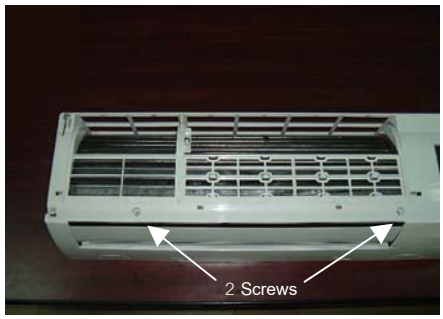
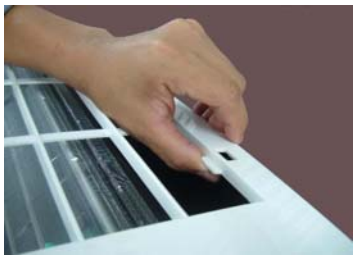
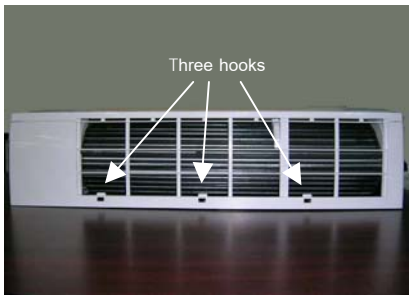
     Flames from the equipment may cause the flammable objects to catch fire.
- **If keeping the power on is absolutely unavoidable while doing a job such as inspecting the circuitry, wear rubber gloves to avoid contact with the live parts.**

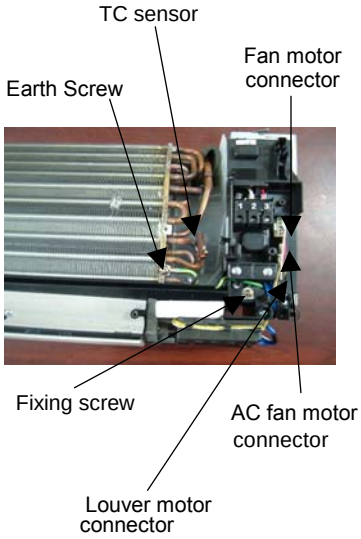
  Electric shocks may be received if the live parts are touched.
  High-voltage circuits are contained inside this unit.

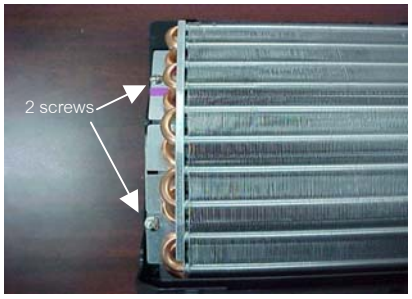
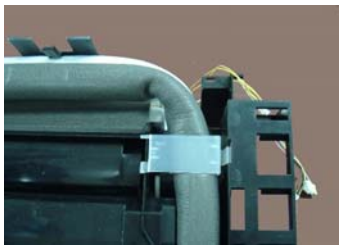
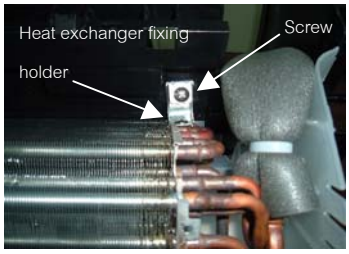
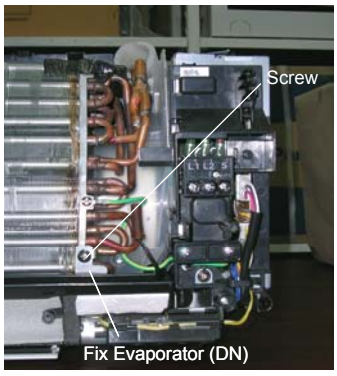
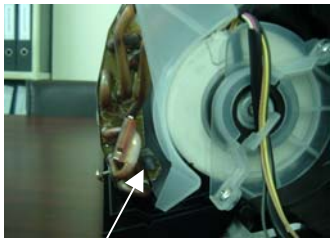
  Proceed very carefully when conducting checks since directly touching the parts on the control circuit board may result in electric shocks.

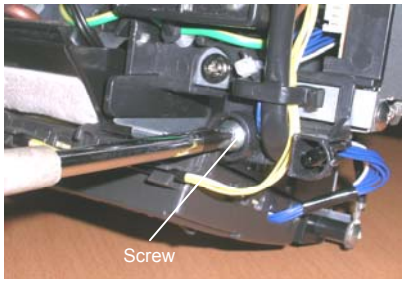
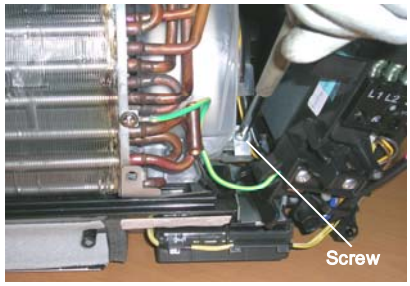
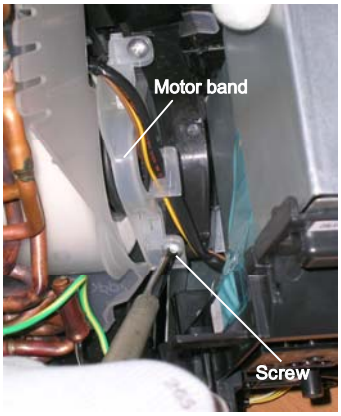
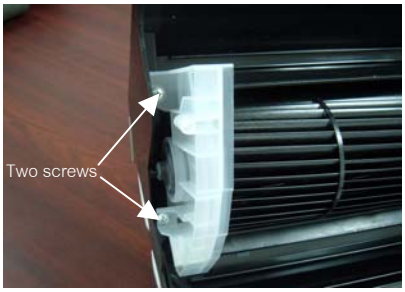
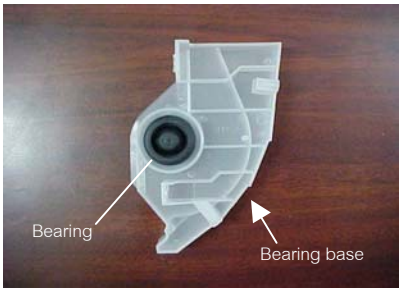
12-1. Indoor Unit

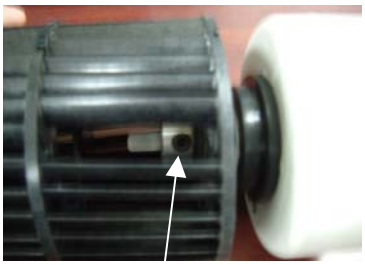
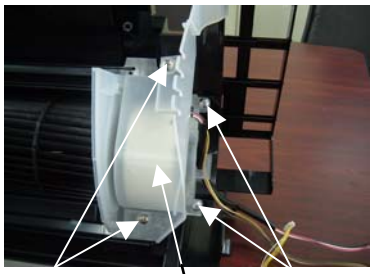
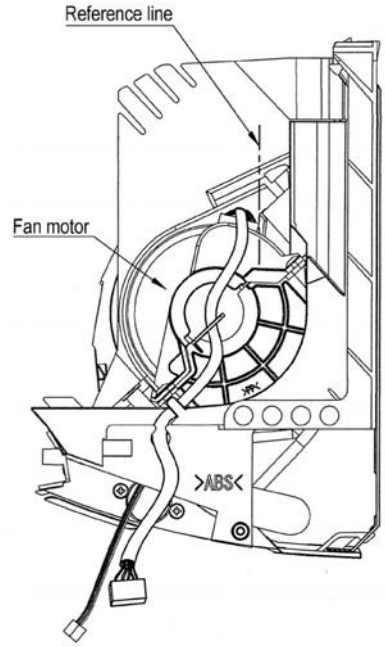
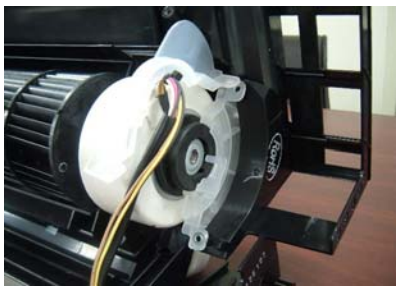
No.	Part name	Procedures	Remarks
①	Front panel	1) Stop operation of the air conditioner and turn off its main power supply. 2) Open the air inlet grille, push the arm toward the outside, and remove the grille. 3) Remove the left and right air filters.	

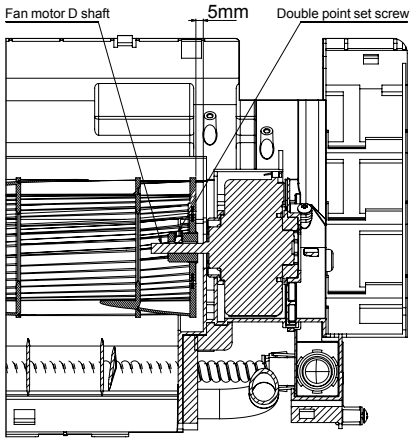
No.	Part name	Procedures	Remarks
①	Front panel	4) Press "PUSH" part under the front panel and remove hooks of the front panel from the installation plate.	
		5) Remove the front panel fixing screws. (2 pcs.) 6) Take off three hooks of panel from rear side.	
			
		<How to assemble the front panel> 1) Press three center positions and two lower center positions of the air outlet, and then hang the hanging hooks (3 pcs.) at the top side of the front panel to the rear plate.	
		2) Tighten two screws. • Incomplete hanging or incomplete pressing may cause a dewdrops or generation of a fluttering sound.	

No.	Part name	Procedures	Remarks
②	Electric parts box assembly	1) Follow the procedure up to 3) in ② above. 2) Remove screw of earth lead attached to the end plate of the evaporator. 3) Remove the lead wire cover, and remove connector for the fan motor and connector for the louver motor from the electric parts box assembly. 4) Pull out TC sensor from sensor holder of the evaporator. 5) Disengage the display unit by simply pushing at the top of the display unit. 6) Remove the fixing screw that secures the electric parts box assembly, and remove the assembly. **<How to assemble the electric parts box>** 1) Hook the top part of the electric parts box assembly onto the claws on the back body, and secure it using the fixing screw. Now attach the display unit. Connect the connectors for the fan motor and louver motor. 2) Secure the grounding wire using the fixing screw. Insert the TC sensor into the sensor holder. * Be absolutely sure to loop the grounding wire and TC sensor leads once at the bottom.	 Electric part box cover 

No.	Part name	Procedures	Remarks
③	Horizontal louver	1) Remove shaft of the horizontal louver from the back body. (First remove the left shaft, and then remove other shafts while sliding the horizontal louver leftward.)	
④	Evaporator (Heat exchanger)	1) Follow to the procedure in the item ③. 2) Remove the pipe holder from the rear side of the main unit. 3) Remove two fixing screws at the left side of the end plate of the heat exchanger.	 
		4) Remove one fixing screw on the heat exchage fixing holder to separate the heat exchage from the back body.	
		5) Remove one screw at below right side of heat exchanger that used for fixing between heat exchanger and back body by Fix Evaporator (DN) The Fix Evaporator (DN) is used for transportation only and can be removed without any concern to unit operation. Follow to 7) for removing.	
		6) Remove right side of the end plate from two fixing rib while sliding slightly the heat exchanger rightward.	

No.	Part name	Procedures	Remarks
④	Evaporator (Heat exchanger)	7) Unscrew one screw which fix Electrical Control Box and the casing. Move Electrical Control Box until can see one screw that fix Motor band and unscrew it then remove FIX-EVA-DN	 
		Tighten the screw of Motor band, assembly Electrical Control Box then tighten screw to complete reassembly.	
⑤	Bearing base	1) Follow to the procedure in the item ④ . 2) Remove the two screws used to secure the bearing base.	
		3) Remove the bearing base. **<Caution at assembling>** • If the bearing is out from the housing, push it into the specified position and then incorporate it in the main body.	

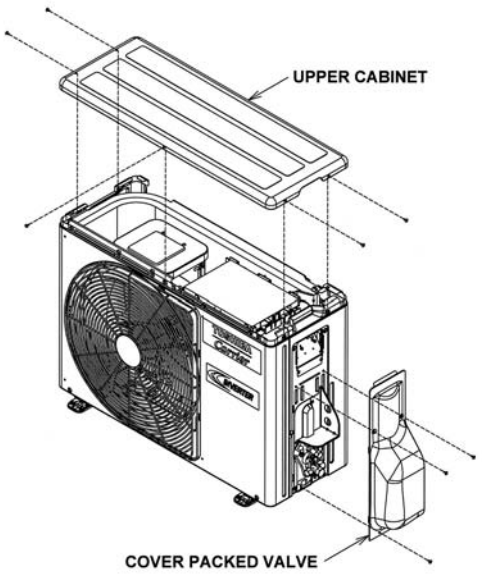
No.	Part name	Procedures	Remarks
⑥	Fan motor	1) Follow to the procedure till item ⑤. 2) Loosen the set screw of the cross flow fan. 3) Remove two fixing screws of the motor cover and them remove the motor cover. 4) Remove two more fixing screws of the motor band and remove the motor band.	 Set screw  Two screw Two screws on motor band Motor cover
		5) Pull the fan motor outward.  Reference condition of Fan Motor's assembly.	

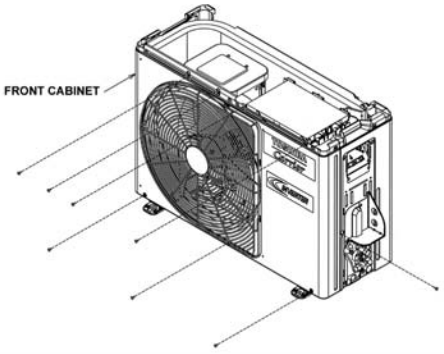
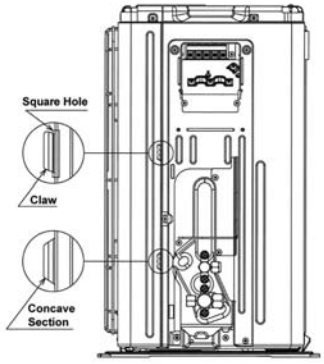
No.	Part name	Procedures	Remarks
⑦	Cross flow fan	**<Caution at reassembling>** 1) To incorporate the fan motor incorporate the motor into the position in the following figure, and then install the fan motor. • Install the cross flow fan so that the right end of the 1st joint from the right of the cross flow fan is set keeping 5.0 mm from closed wall of the main unit. • Holding the set screw, install the cross flow fan so that flat area on shaft of the fan motor comes to the mounting hole of the set screw. • Perform positioning of the fan motor as follows: • When assembling the fan motor, the fan motor must be installed in such a way that the fan motor leads will be taken out is positioned at the bottom front. • After assembling the two hooking claws of the motor band (right) into the main body, position the fan motor, insert it, and then secure the motor band (right) using the two fixing screws.	

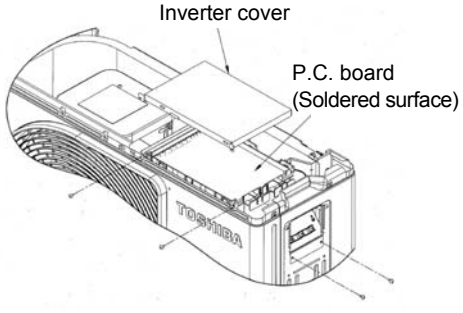
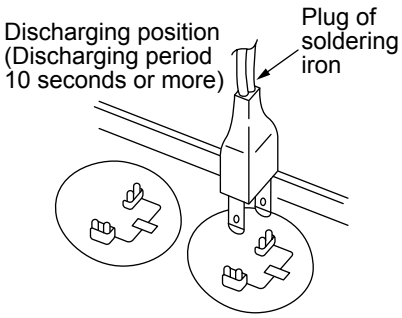
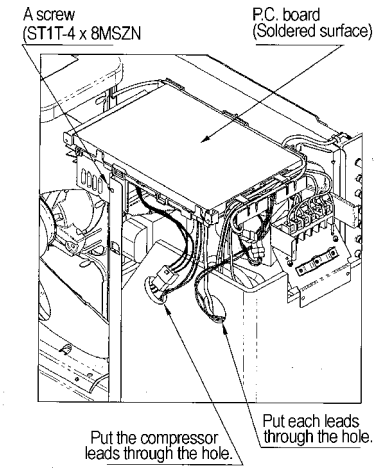
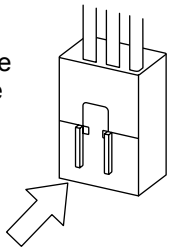
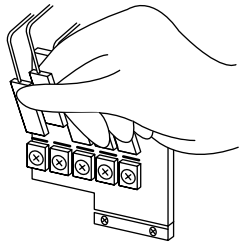
12-2. Microcomputer

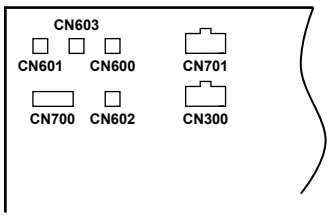
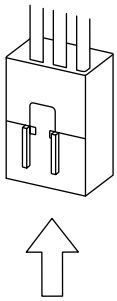
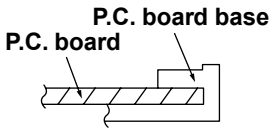
No.	Part name	Procedure	Remarks
①	Common procedure	1) Turn the power supply off to stop the operation of air-conditioner. 2) Remove the front panel. • Remove the 2 fixing screws. 3) Remove the electrical part base.	Replace terminal block, microcomputer ass'y and the P.C. board ass'y.

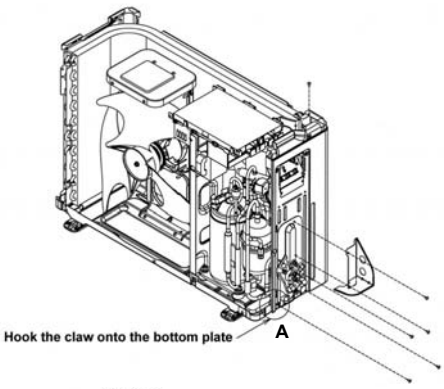
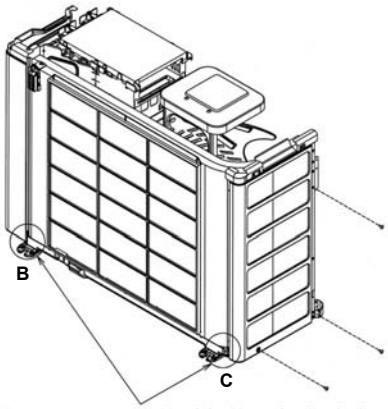
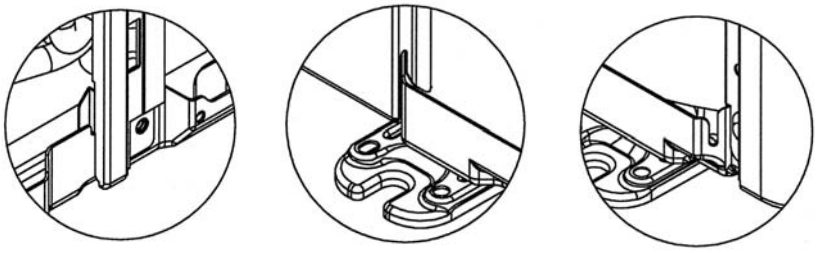
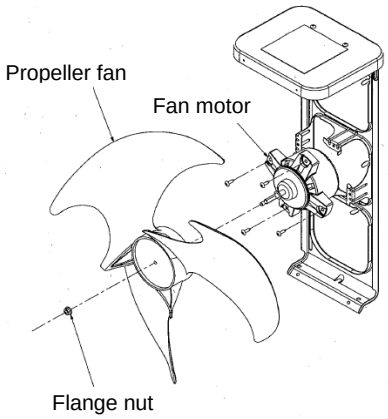
12-3. Outdoor Unit

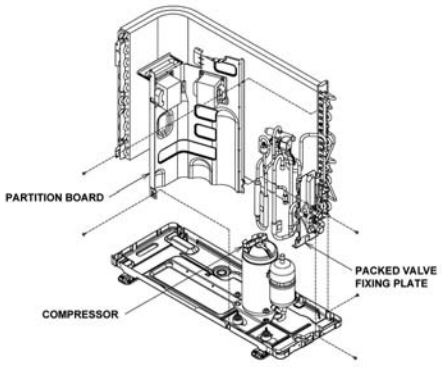
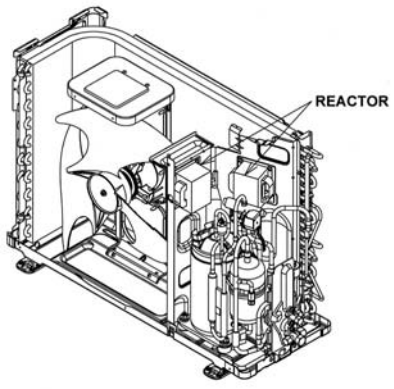
No.	Part name	Procedure	Remarks
①	Common procedure	**1. Detachment** **NOTE** **Wear gloves for this job. Otherwise, you may injure your hands on the parts, etc.** 1) Stop operation of the air conditioner, and turn off the main switch of the breaker for air conditioner. 2) Remove the valve cover. (screw 3 pcs.) • After removing screw, remove the valve cover pulling it downward. 3) Remove cord clamp (screw 3 pcs.) and then remove connecting cable. 4) Remove the upper cabinet. (screw 5 pcs.) • After removing screws, remove the upper cabinet pulling it upward. **2. Attachment** 1) Attach the upper cabinet. (screw 5 pcs.) 2) Perform cabling of connecting cable, and attach the cord clamp. • Fix the cord clamp by tightening the screws (screw 3 pcs.) fitting 2 concave parts of the cord clamp to each connecting cables. 3) Attach the valve cover. (screw 3 pcs.) • Insert the upper part into the square hole of the side cabinet, set hook claws of the valve cover to square holes (at two positions) of the main unit, and attach it pushing upward,	

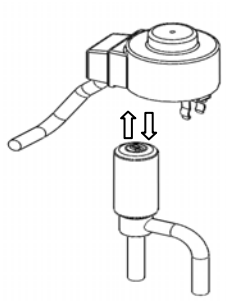
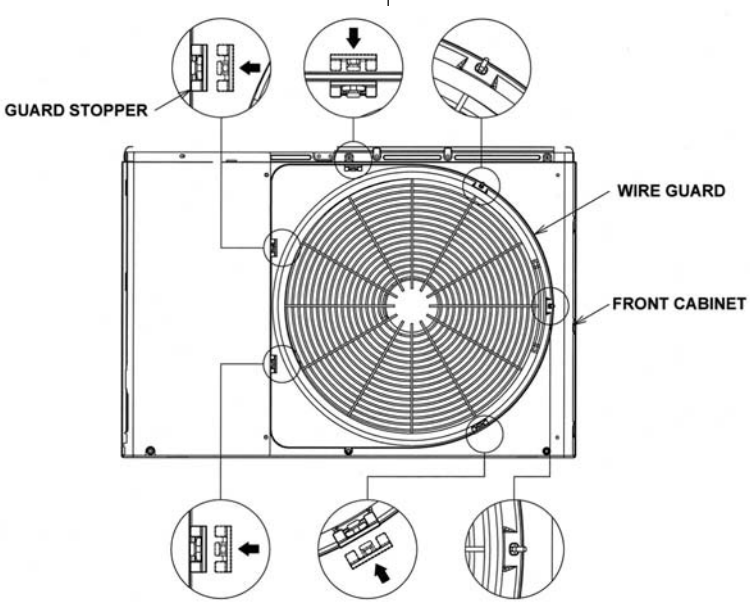
No.	Part name	Procedure	Remarks
②	Front cabinet	**1. Detachment** 1) Perform step 1 in ①. 2) Remove the fixing screws (screw 2 pcs.) used to secure the front cabinet and inverter cover, the screws (screw 3 pcs.) used to secure the front cabinet at the bottom, the screw used to secure the front and side cabinet (Right), and the screws (screw 2 pcs.) used to secure the motor base. • The front cabinet is fitted into the side cabinet (left) at the front left side so pull up the top of the front cabinet to remove it. **2. Attachment** 1) Insert the claw on the front left side into the side cabinet (left). 2) Hook the bottom part of the front right side onto the concave section of the bottom plate. Insert the claw of the side cabinet (right) into the square hole in the front cabinet. 3) Return the screws that were removed above to their original positions and attach them.	 

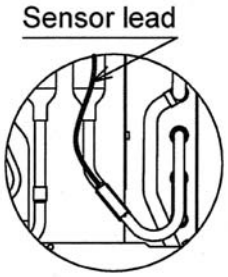
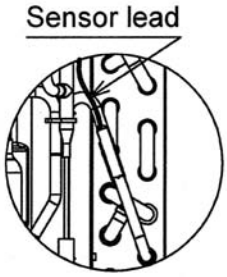
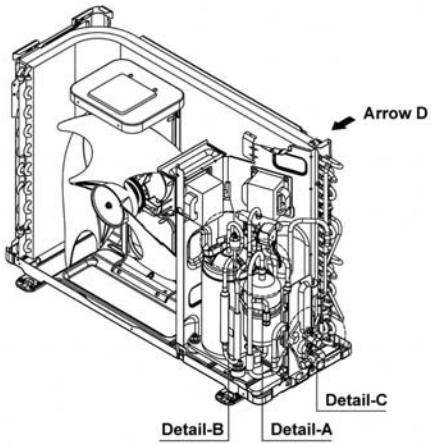
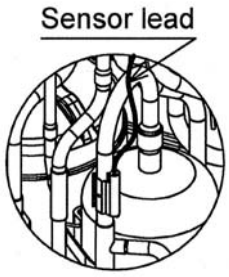
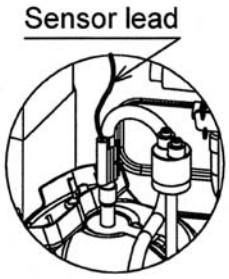
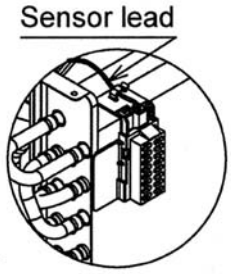
No.	Part name	Procedure	Remarks
③	Inverter assembly	1) Perform work of item 1 in ①. 2) Remove screw (ST1TØ4 × 10L 2 pcs.) of the upper part of the front cabinet. • If removing the inverter cover in this condition, P.C. board can be checked. • If there is no space above the unit, perform work of 1 in ②. **Be careful to check the inverter because high-voltage circuit is incorporated in it.** 3) Perform discharging by connecting ⊕, ⊖ polarity by discharging resistance (approx. 100Ω40W) or plug of soldering iron to ⊕, ⊖ terminals a of the C14 (printed "CAUTION HIGH VOLTAGE" is attached.) electrolytic capacitor (500μF) on P.C. board. **Be careful to discharge the capacitor because the electrolytic capacitor cannot naturally discharge and voltage remains according to trouble type in some cases.** **NOTE** **This capacitor is one with mass capacity. Therefore, it is dangerous that a large spark generates if short-circuiting between ⊕, ⊖** 4) Remove screw (ST1T∅4 x 10L 4pcs.) fixing the terminal part of inverter box to the main body. 5) Remove the front cabinet by performing step 1 in ② , and remove the fixing screws (ST1T∅4 x 10L) for securing the main body and inverter box. 6) Remove various lead wires from the holder at upper part of the inverter box. 7) Pull the inverter box upward. 8) Disconnect connectors of various lead wires. **Requirement** **As each connector has a lock mechanism, avoid to remove the connector by holding the lead wire, but by holding the connector.**	   The connector is one with lock, so remove it while pushing the part indicated by an arrow.   Be sure to remove the connector by holding the connector, not by pulling the lead wire.

No.	Part name	Procedure	Remarks
④	Control board assembly	1. Disconnect the leads and connectors connected to the other parts from the control board assembly. 1) Leads • 3 leads (black, white, orange) connected to terminal block. • Lead connected to compressor : Disconnect the connector (3P). • Lead connected to reactor : Disconnect the two connectors (2P). 2) Connectors (×8) CN300 : Outdoor fan motor (3P: white)* (* : See **Note**) CN701 : 4-way valve (2P: yellow)* CN600 : TE sensor (2P: white)* CN700 : PMV (6P: white) CN603 : TS sensor (3P: white)* CN601 :TD sensor (3P: white)* CN602 : TO sensor (2P: white) **NOTE** These connectors have a disconnect prevention mechanism: as such, the lock on their housing must be released before they are disconnected. 2. Remove the control board assembly from the P.C. board base. (Remove the heat sink and control board assembly while keeping them screwed together.) **NOTE** Disengage the four claws of the P.C. board base, hold the heat sink, and lift to remove it. 3. Remove the two fixing screws used to secure the heat sink and control board assembly. 4. Mount the new control board assembly. **NOTE** When mounting the new control board assembly, ensure that the P.C. board is inserted properly into the P.C. board support groove.	 CN300, CN701, CN600 and CN603 are connectors with locking mechanisms: as such, to disconnect them, they must be pressed in the direction of the arrow while pulling them out.  

No.	Part name	Procedure	Remarks
⑤	Side cabinet	**1. Side cabinet (right)** 1) Perform step 1 in ② and all the steps in ③. 2) Remove the fixing screw used to secure the side cabinet and heat exchanger. 3) Remove the fixing screw (screw 2 pcs.) used to secure the plate conduit and side cabinet. 4) Remove the fixing screw (screw 3 pcs.) used to secure the side cabinet to the bottom plate and valve fixing panel. **2. Side cabinet (left)** 1) Perform step 1 in ②. 2) Remove the fixing screw used to secure the side cabinet (left) onto the heat exchanger. 3) Remove the fixing screw (SCREW 2 pcs.) used for securing the side cabinet to the bottom plate and heat exchanger.	  The back body section hooked onto the bottom plate hear.  Detail A Detail B Detail C
⑥	Fan motor	1) Perform work of item 1 of ① and ②. 2) Remove the flange nut fixing the fan motor and the propeller. • Flange nut is loosened by turning clockwise. (To tighten the flange nut, turn counterclockwise.) 3) Remove the propeller fan. 4) Disconnect the connector for fan motor from the inverter. 5) Remove the fixing screws (4 pcs.) holding by hands so that the fan motor does not fall. * Precautions when assembling the fan motor Tighten the flange nut using a tightening torque of 3.3 lbf·ft (4.5 N·m).	

No.	Part name	Procedure	Remarks
⑦	Compressor	1) Perform work of item 1 of ① and ②, ③, ④, ⑤. 2) Extract refrigerant gas. 3) Remove the partition board. (screw 3 pcs.) 4) Remove the sound-insulation material. 5) Remove terminal cover of the compressor, and disconnect lead wire of the compressor from the terminal. 6) Remove pipe connected to the compressor with a burner. • Take care to keep the 4-way valve away from naked flames. (Otherwise, it may malfunction.) 7) Remove the fixing screw of the bottom plate and heat exchanger. 8) Remove the fixing screw of the bottom plate and valve fixing plate. 9) Pull upward the refrigeration cycle. 10) Remove NUT (3 pcs.) fixing the compressor to the bottom plate.	
⑧	Reactor	1) Perform work of item 1 of ②, and ③. 2) Remove screws fixing the reactors. (screw 5 pcs.)	

No.	Part name	Procedure	Remarks
⑨	Electronic expansion valve coil	**1. Detachment** 1) Perform step 1 in ②, all the steps in ③ and 1 in ⑤. 2) Remove the coil by pull it upward. **2. Attachment** 1) Insert a valve coil to value body by push it downward. And confirm to fix it surely.	
⑩	Wire guard	**1. Detachment** 1) Perform work of item 1 of ②. 2) Remove the front cabinet, and put it down so that wire guard side directs downward. **Perform work on a corrugated cardboard, cloth, etc. to prevent flaw to the product.** 3) Remove the guard stopper (4 pcs.) from hook of wire guard. 4) Turn the front cabinet into opposite site then pull wire guard up ward. **2. Attachment** 1) Insert claws (2 positions) of the wire guard in the holes of the front cabinet. Push the hook (4 positions) by hands and fix by guard stopper. **Check that all the claws & hooks are fixed to the specified positions.**	

No.	Part name	Procedure	Remarks
⑪	TE sensor (outdoor heat exchanging temperature sensor)	• **Attachment** Install the sensor onto the straight pipe part of the condenser output pipe.  Detail C for 09EAV-UL 09EAV2-UL  Detail C for 12EAV-UL 12EAV2-UL	
⑫	TS sensor (Suction pipe temperature sensor)	• **Attachment** Install the senser onto the straight pipe part of the suction pipe. Be careful for the lead direction of the sensor.  Detail A	 **Detail-B** TD sensor
⑬	TD sensor (Discharge pipe temperature sensor)	• **Attachment** With its leads pointed upward, install the sensor onto the vertical straight pipe part of the discharge pipe.	
⑭	TO sensor (Outside air temperature sensor)	• **Attachment** Insert the outdoor air temperature sensor into the holder, and install the holder onto the heat exchanger.	 **Arrow-D** TO sensor

CAUTION

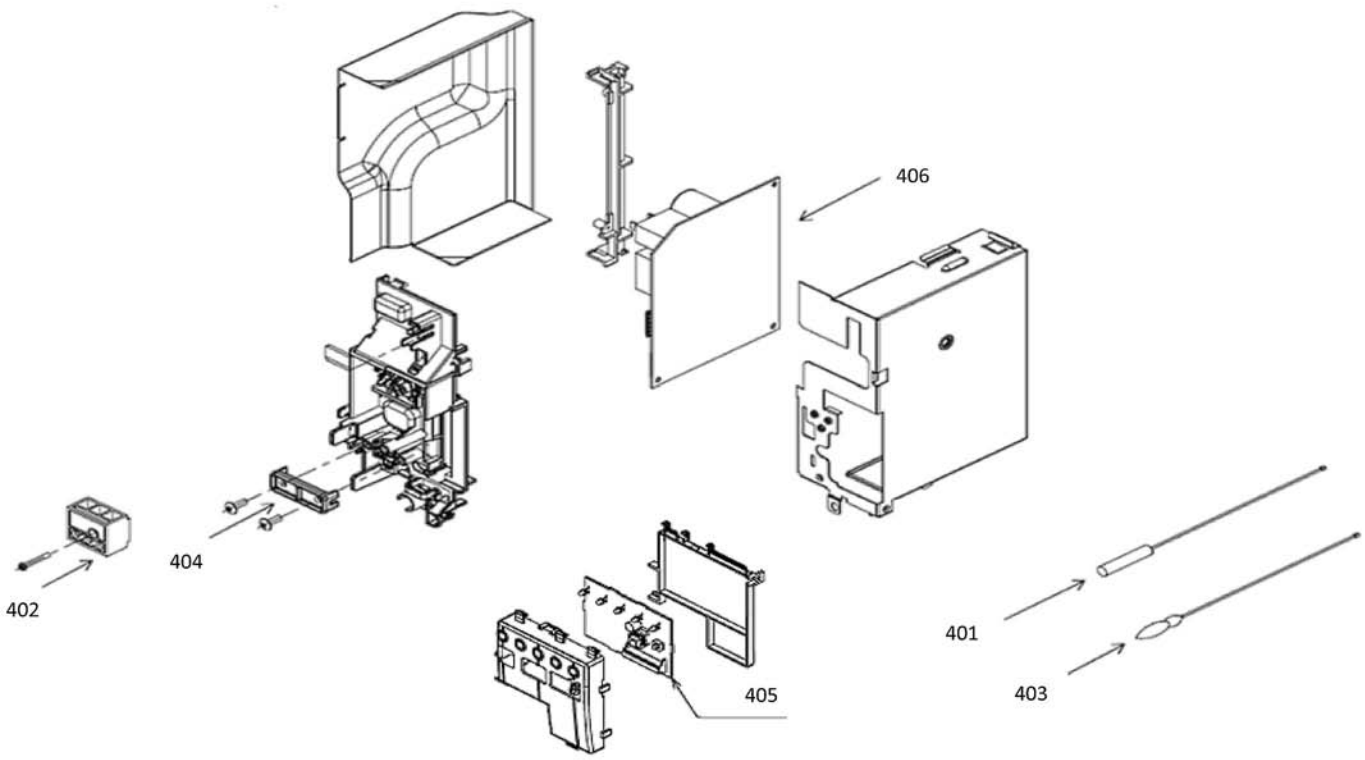
During the installation work (and on its completion), take care not to damage the coverings of the sensor leads on the edges of the metal plates or other parts. It is dangerous for these coverings to be damaged since damage may cause electric shocks and/or a fire.

CAUTION

After replacing the parts, check whether the positions where the sensors were installed are the proper positions as instructed. The product will not be controlled properly and trouble will result if the sensors have not been installed in their proper positions.

13. EXPLODED VIEWS AND PARTS LIST

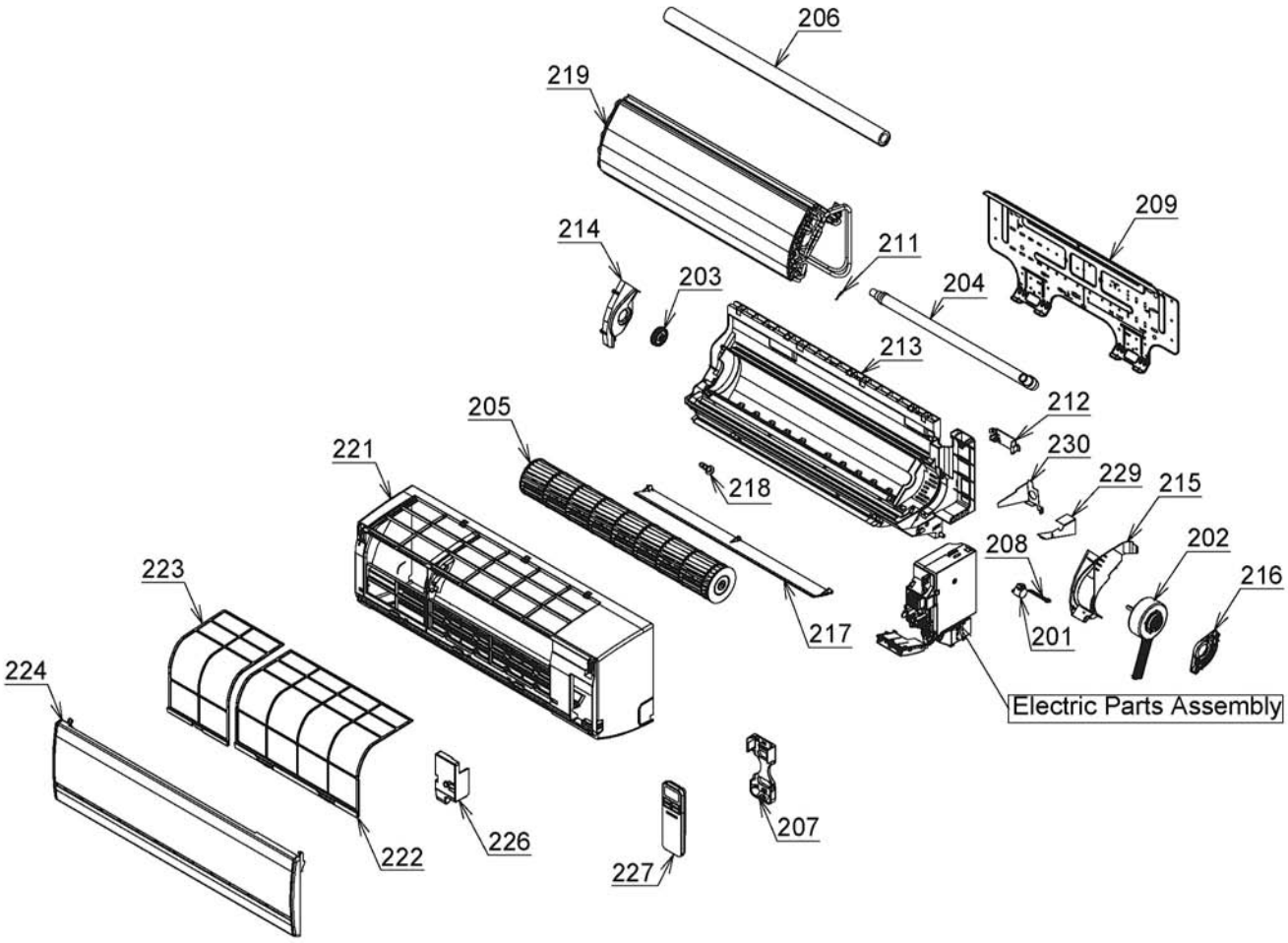
13-1. Indoor Unit (E-Part)



Location No.	Part No.	Description
401	43T50326	TEMPERATURE SENSOR
402	43T60401	TERMINAL BLOCK: 3P
403	43T50325	TEMPERATURE SENSOR
404	43T62003	CORD CLAMP

Location No.	Part No.	Description
405	43T6V316	PC BOARD ASSY;WRS-LED
406	43T69854	PC BOARD (RAS-09EKV-UL)
406	43T6V440	PC BOARD (RAS-12EKV-UL)

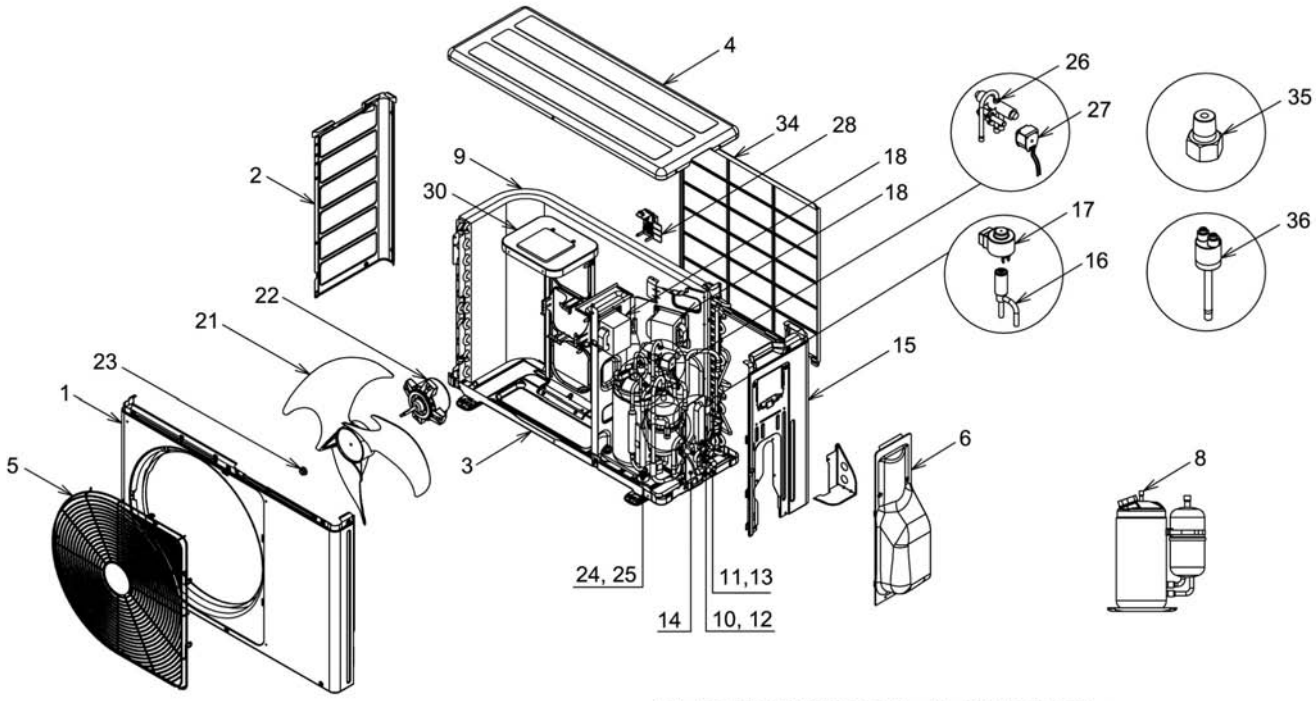
13-2. Indoor Unit



Location No.	Part No.	Description
201	43T21442	STEPPING-MOTOR
202	43T21409	FAN-MOTOR (RAS-09EKV-UL)
202	43T21421	FAN MOTOR (RAS-12EKV-UL)
203	43T22312	BEARING ASSY, MOLD
204	43T70313	HOSE, DRAIN
205	43T20325	CROSS FLOW FAN ASSEMBLY
206	43T11317	PIPE SHIELD
207	43T83003	HOLDER, REMOTE CONTROL
208	43T60382	MOTOR CORD
209	43T82310	INSTALLATION PLATE
211	43T19333	HOLDER, SENSOR
212	43T09408	PIPE HOLDER
213	43T03378	BACK BODY ASSEMBLY
214	43T39338	BEARING BASE

Location No.	Part No.	Description
215	43T39328	MOTOR BAND (LEFT)
216	43T39329	MOTOR BAND (RIGHT)
217	43T09409	HORIZONTAL LOUVER
218	43T79313	CAP, DRAIN
219	43T44446	REFRIGERANT CYCLE ASSEMBLY
221	43T00488	PANEL SERVICE ASSEMBLY
222	43T80327	FILTER-AIR-R
223	43T80328	FILTER-AIR-L
224	43T09491	GRILLE OF AIR INLET
226	43T62328	TERMINAL COVER
227	43T66308	REMOTE CONTROLLER
229	43T82311	PARTITION CONDUIT
230	43T82312	MOUNT CONDUIT

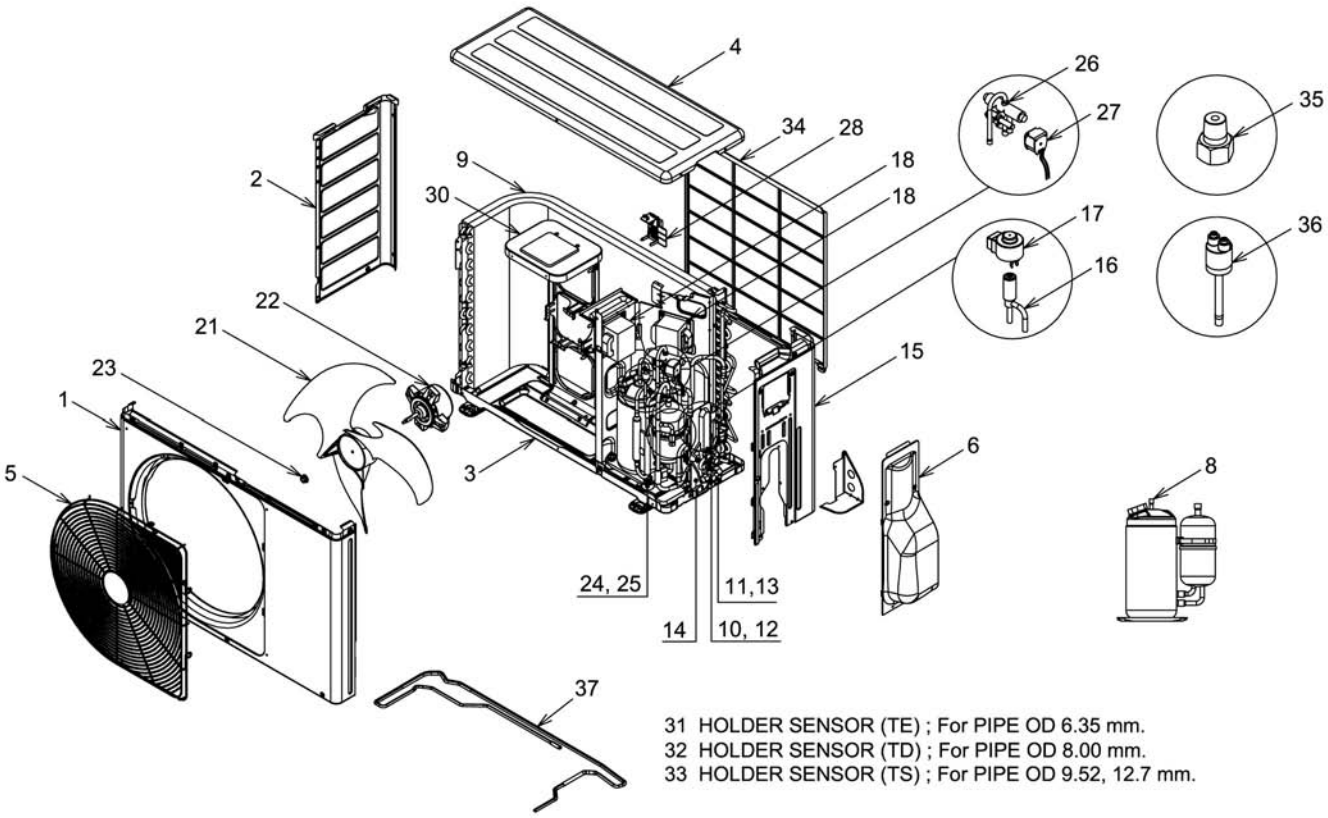
13-3. Outdoor Unit (RAS-09,12EAV-UL)



Location No.	Part No.	Description
1	43T00535	FRONT CABINET
2	43T00459	LEFT CABINET
3	43T42327	BASE PLATE ASSEMBLY
4	43T00452	UPPER CABINET
5	43T19342	WIRE GUARD
6	43T00540	PACKED VALVE COVER
8	43T41420	COMPRESSOR (RAS-09EAV-UL)
8	43T41431	COMPRESSOR (RAS-12EAV-UL)
9	43T43446	CONDENSER ASSEMBLY (RAS-09EAV-UL)
9	43T43447	CONDENSER ASSEMBLY (RAS-12EAV-UL)
10	43T46358	VALVE;PACKED 6.35 DIA
11	43T46366	VALVE;PACKED 9.52 DIA
12	43T47331	BONNET, 6.35 DIA
13	43T47332	BONNET, 9.52 DIA
14	43T00539	FIXING PLATE VALVE
15	43T00537	RIGHT CABINET ASSEMBLY
16	43T46360	BODY PMV

Location No.	Part No.	Description
17	43T63325	COIL PMV
18	43T58311	REACTOR (RAS-09EAV-UL)
18	43T58306	REACTOR (RAS-12EAV-UL)
21	43T20319	PROPELLER FAN
22	43T21419	FAN-MOTOR
23	43T47001	NUT FLANGE
24	43T97001	NUT
25	43T49335	RUBBER CUSHION
26	43T46359	4WAY VALVE
27	43T63324	4WAY VALVE COIL ASSEMBL
28	43T63319	HOLDER,SENSOR
30	43T39337	MOTOR BASE CONNECTION PLATE
31	43T63318	HOLDER SENSOR
32	43T63317	HOLDER,SENSOR
33	43T63316	HOLDER,SENSOR
34	43T19331	FIN GUARD
35	43T49338	FUSIBLE PLUG
36	43T63330	PRESSURE SWITCH

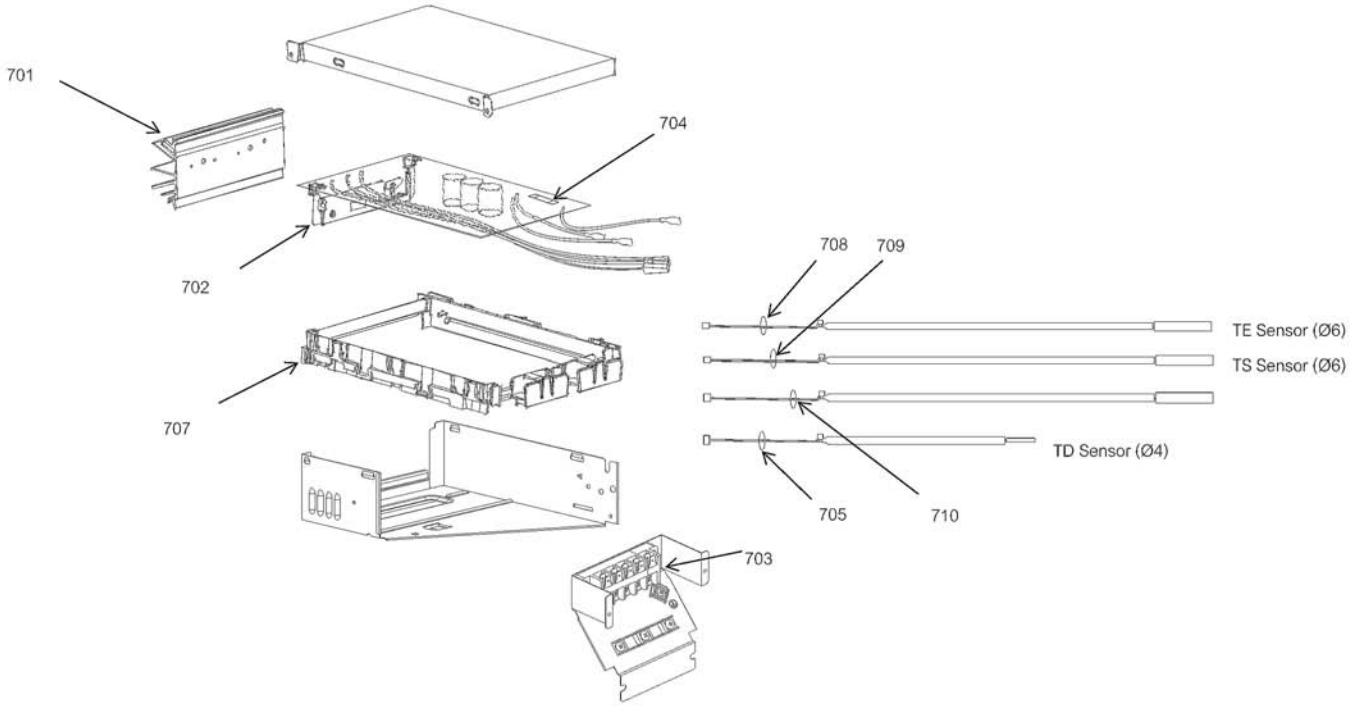
13-4. Outdoor Unit (RAS-09,12EAV2-UL)



Location No.	Part No.	Description
1	43T00535	FRONT CABINET
2	43T00459	LEFT CABINET
3	43T42353	BASE PLATE ASSEMBLY
4	43T00452	UPPER CABINET
5	43T19342	WIRE GUARD
6	43T00540	PACKED VALVE COVER
8	43T41420	COMPRESSOR (RAS-09EAV2-UL)
8	43T41431	COMPRESSOR (RAS-12AV2-UL)
9	43T43446	CONDENSER ASSEMBLY (RAS-09EAV2-UL)
9	43T43447	CONDENSER ASSEMBLY (RAS-12EAV2-UL)
10	43T46358	VALVE;PACKED 6.35 DIA
11	43T46366	VALVE;PACKED 9.52 DIA
12	43T47331	BONNET, 6.35 DIA
13	43T47332	BONNET, 9.52 DIA
14	43T00539	FIXING PLATE VALVE
15	43T00537	RIGHT CABINET ASSEMBLY
16	43T46360	BODY PMV

Location No.	Part No.	Description
17	43T63325	COIL PMV
18	43T58306	REACTOR (RAS-12EAV2-UL)
18	43T58311	REACTOR (RAS-09EAV2-UL)
21	43T20319	PROPELLER FAN
22	43T21419	FAN-MOTOR
23	43T47001	NUT FLANGE
24	43T97001	NUT
25	43T49335	RUBBER CUSHION
26	43T46359	4WAY VALVE
27	43T63324	4WAY VALVE COIL ASSEMBL
28	43T63319	HOLDER,SENSOR
30	43T39337	MOTOR BASE CONNECTION PLATE
31	43T63318	HOLDER SENSOR
32	43T63317	HOLDER,SENSOR
33	43T63316	HOLDER,SENSOR
34	43T19331	FIN GUARD
35	43T49338	FUSIBLE PLUG
36	43T63330	PRESSURE SWITCH
37	43T57302	HEATER CORD ASSEMBLY

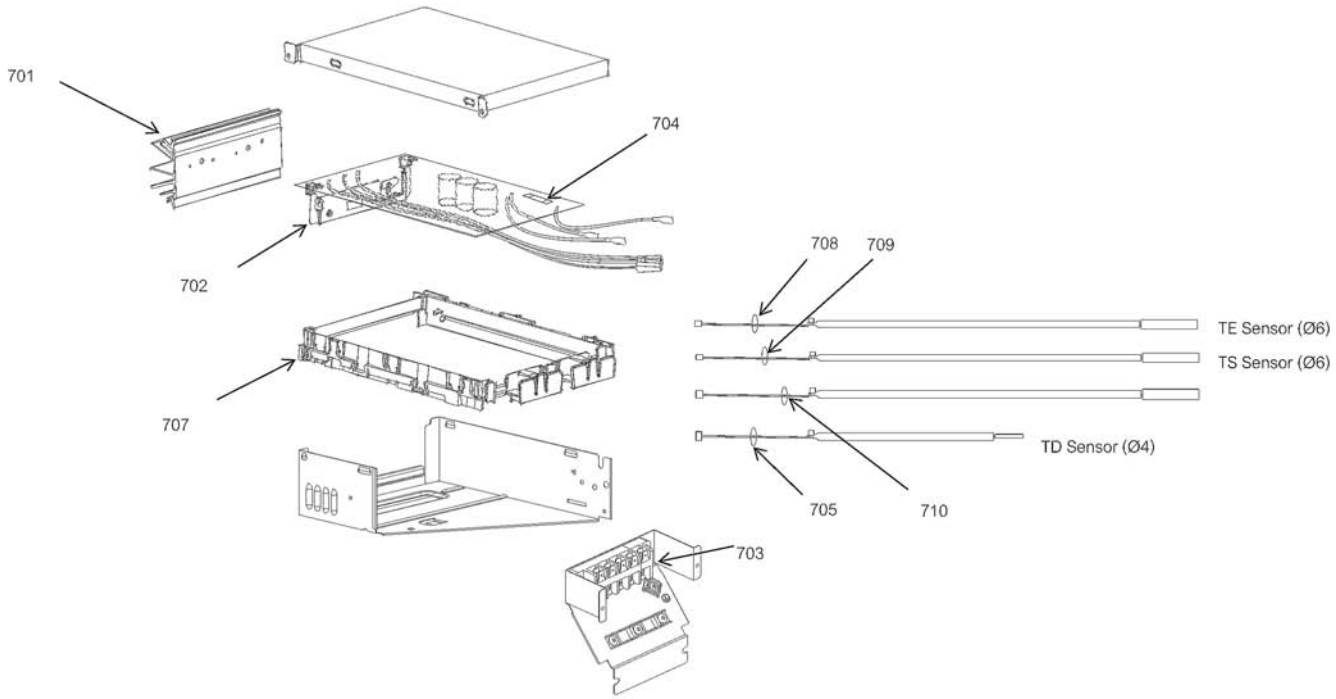
13-5. P.C. Board Layout (RAS-09,12EAV-UL)



Location No.	Part No.	Description
701	43T62320	HEATSINK
702	43T6V432	PC-BOARD (RAS-09EAV-UL)
702	43T6V433	PC-BOARD (RAS-12EAV-UL)
703	43T60404	TERMINAL-5P
704	43T60403	FUSE

Location No.	Part No.	Description
705	43T50328	TEMPERATURE SENSOR
707	43T62313	BASE-PLATE-PC
708	43T50329	SENSOR,HEAT EXCHANGER
709	43T50330	SENSOR,HEAT EXCHANGER
710	43T50331	SENSOR,HEAT EXCHANGER

13-6. P.C. Board Layout (RAS-09,12EAV2-UL)



Location No.	Part No.	Description
701	43T62320	HEATSINK
702	43T6V434	PC-BOARD (RAS-09EAV2-UL)
702	43T6V435	PC-BOARD (RAS-12EAV2-UL)
703	43T60404	TERMINAL-5P
704	43T60403	FUSE

Location No.	Part No.	Description
705	43T50328	TEMPERATURE SENSOR
707	43T62313	BASE-PLATE-PC
708	43T50329	SENSOR,HEAT EXCHANGER
709	43T50330	SENSOR,HEAT EXCHANGER
710	43T50331	SENSOR,HEAT EXCHANGER

TOSHIBA CARRIER (THAILAND) CO.,LTD.
144/9 MOO 5, BANGKADI INDUSTRIAL PARK, TIVANON ROAD, TAMBOL BANGKADI,
AMPHUR MUANG, PATHUMTHANI 12000, THAILAND.

TOSHIBA
Carrier

TCTC-E13-007-2

ENGINEERING DATA BOOK

INDOOR UNIT / OUTDOOR UNIT

RAS-09EKV-UL / RAS-09EAV2-UL

RAS-12EKV-UL / RAS-12EAV2-UL

RAS-15EKV-UL / RAS-15EAV2-UL

RAS-17EKV-UL / RAS-17EAV2-UL

RAS-22EKV-UL / RAS-22EAV2-UL

Nov, 2013 First Edition

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Product lineup

High wall	Size	9	12	15	17	22	
	Outdoor unit						
	Model name	RAS-09EAV2-UL	RAS-12EAV2-UL	RAS-15EAV2-UL	RAS-17EAV2-UL	RAS-22EAV2-UL	**ASM-OPTIONAL-RC**
	RAS-09EKV-UL	●	-	-	-	-	°F Display (WH-TA14NE) 1111855001
	RAS-12EKV-UL	-	●	-	-	-	
	RAS-15EKV-UL	-	-	●	-	-	or
	RAS-17EKV-UL	-	-	-	●	-	°C Display (WH-TA15NE) 1111855002
	RAS-22EKV-UL	-	-	-	-	●	

Specifications

System	Size		9	12	15	17	22
	Outdoor Model		**RAS-09EAV2-UL**	**RAS-12EAV2-UL**	**RAS-15EAV2-UL**	**RAS-17EAV2-UL**	**RAS-22EAV2-UL**
	Indoor Model		**RAS-09EKV-UL**	**RAS-12EKV-UL**	**RAS-15EKV-UL**	**RAS-17EKV-UL**	**RAS-22EKV-UL**
Performance	Cooling Rated Capacity	Btu/h	9000	12000	15000	16200	21400
	Cooling Range Capacity		3750 - 10580	2750 - 13950	2750 - 17050	3750 - 20450	4100 - 22500
	EER	Btu/W.h	13.00	12.60	13.00	12.60	8.30
	SEER	Btu/W.h	20	23	20	19	15.5
	Heating Rated Capacity	Btu/h	10800	14200	18000	20200	23200
	Heating Range Capacity		3070 - 16350	3070 - 19000	2750 - 21500	2750 - 21500	3450 - 24350
	COP	Btu/W.h	13.50	13.00	12.80	12.40	10.50
	HSPF		10	9.7	10	10	10
Controls	Wireless (℃, °F, Convertible)		Standards	Standards	Standards	Standards	Standards
	Wired (℃, °F, Convertible)		Optional	Optional	Optional	Optional	Optional
Operating Range	**Cooling**						
	Outdoor Min - Max DB	°F	0~115	0~115	0~115	0~115	0~115
	Indoor Min - Max DB	°F	70~90	70~90	70~90	70~90	70~90
	Heating						
	Outdoor Min - Max DB	°F	-4~75	-4~75	-4~75	-4~75	-4~75
	Indoor Min - Max DB	°F	32~82	32~82	32~82	32~82	32~82
Piping	Min. Piping Length	ft (m)	6.6 (2)	6.6 (2)	6.6 (2)	6.6 (2)	6.6 (2)
	Standard Piping Length	ft (m)	16 (5)	16 (5)	25 (7.5)	25 (7.5)	25 (7.5)
	Max. Piping Length with no additional refrigerant charge	ft (m)	50 (15)	50 (15)	50 (15)	50 (15)	50 (15)
	Max. Piping Length	ft (m)	66 (20)	66 (20)	66 (20)	66 (20)	66 (20)
	Gas Pipe (size/connection type)	in	3/8	3/8	1/2	1/2	1/2
	Liquid Pipe (size/connection type)	in	1/4	1/4	1/4	1/4	1/4
Electrical	Voltage	V-Ph-Hz	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
	Cooling Power Consumption	W	690 (250 - 820)	950 (150 - 1250)	1150 (160 - 1720)	1285 (190 - 2010)	2570 (210 - 2720)
	Heating Power Consumption	W	800 (170 - 1400)	1090 (160 - 1580)	1400 (143 - 1900)	1630 (150 - 1910)	2200 (190 - 2440)
	Cooling Running Current	A @208V	3.68 (1.50 - 4.15)	4.81 (1.03 - 6.26)	5.75 (1.04 - 8.40)	6.45 (1.23 - 9.90)	12.8 (1.38 - 13.40)
		A @230V	3.33 (1.36 - 3.75)	4.35 (0.93 - 5.66)	5.20 (0.94 - 7.60)	5.80 (1.12 - 8.90)	11.5 (1.25 - 12.10)
	Heating Running Current	A @208V	4.13 (1.02 - 6.86)	5.51 (1.10 - 7.75)	6.97 (1.07 - 9.80)	8.10 (1.00 - 9.40)	10.9 (1.26 - 12.00)
		A @230V	3.74 (0.92 - 6.21)	4.99 (0.99 - 7.00)	6.30 (0.96 - 8.80)	7.30 (0.90 - 8.50)	9.9 (1.14 - 10.80)
	MCA	A	10	13	13	13	15
	MOPA	A	15	20	20	20	25
Outdoor	**Dimensions**						
	Height	in (mm)	21-11/16 (550)	21-11/16 (550)	21-11/16 (550)	21-11/16 (550)	21-11/16 (550)
	Width	in (mm)	30-11/16 (780)	30-11/16 (780)	30-11/16 (780)	30-11/16 (780)	30-11/16 (780)
	Length	in (mm)	11-7/16 (290)	11-7/16 (290)	11-7/16 (290)	11-7/16 (290)	11-7/16 (290)
	Weight -Gross/Net	lbs (kg)	88 (40)/82 (37)	95 (43)/88 (40)	98 (44) /91 (41)	98 (44) /91 (41)	100 (45) /93 (42)
	Sound Pressure	dBa	47	50	51	52	53
Indoor	**Dimensions**						
	Width	in (mm)	10-25/32 (275)	10-25/32 (275)	12-19/32 (320)	12-19/32 (320)	12-19/32 (320)
	Height	in (mm)	31-1/8 (790)	31-1/8 (790)	41-5/16 (1050)	41-5/16 (1050)	41-5/16 (1050)
	Length	in (mm)	8-1/16 (205)	8-1/16 (205)	8-15/16 (228)	8-15/16 (228)	8-15/16 (228)
	Weight -Gross/Net	lbs (kg)	25 (11)/20 (9)	25 (11)/20 (9)	35 (16)/29 (13)	35 (16)/29 (13)	35 (16)/29 (13)
	Sound Pressure at Different Speeds (clg)	dBa	39/36/34/30/27	45/42/40/35/30	44/41/38/35/32	47/44/41/38/35	47/44/41/38/35
	Sound Pressure at Different Speeds (htg)	dBa	40/37/35/32/29	46/43/41/36/32	44/41/39/35/32	47/44/42/38/35	47/44/42/38/35
	Air flow (H/M/L) (clg)	CFM	303/244/177	406/304/219	562/445/346	636/505/388	636/505/388
	Air flow (H/M/L) (htg)	CFM	335/272/211	438/353/247	583/505/374	646/572/420	646/572/420

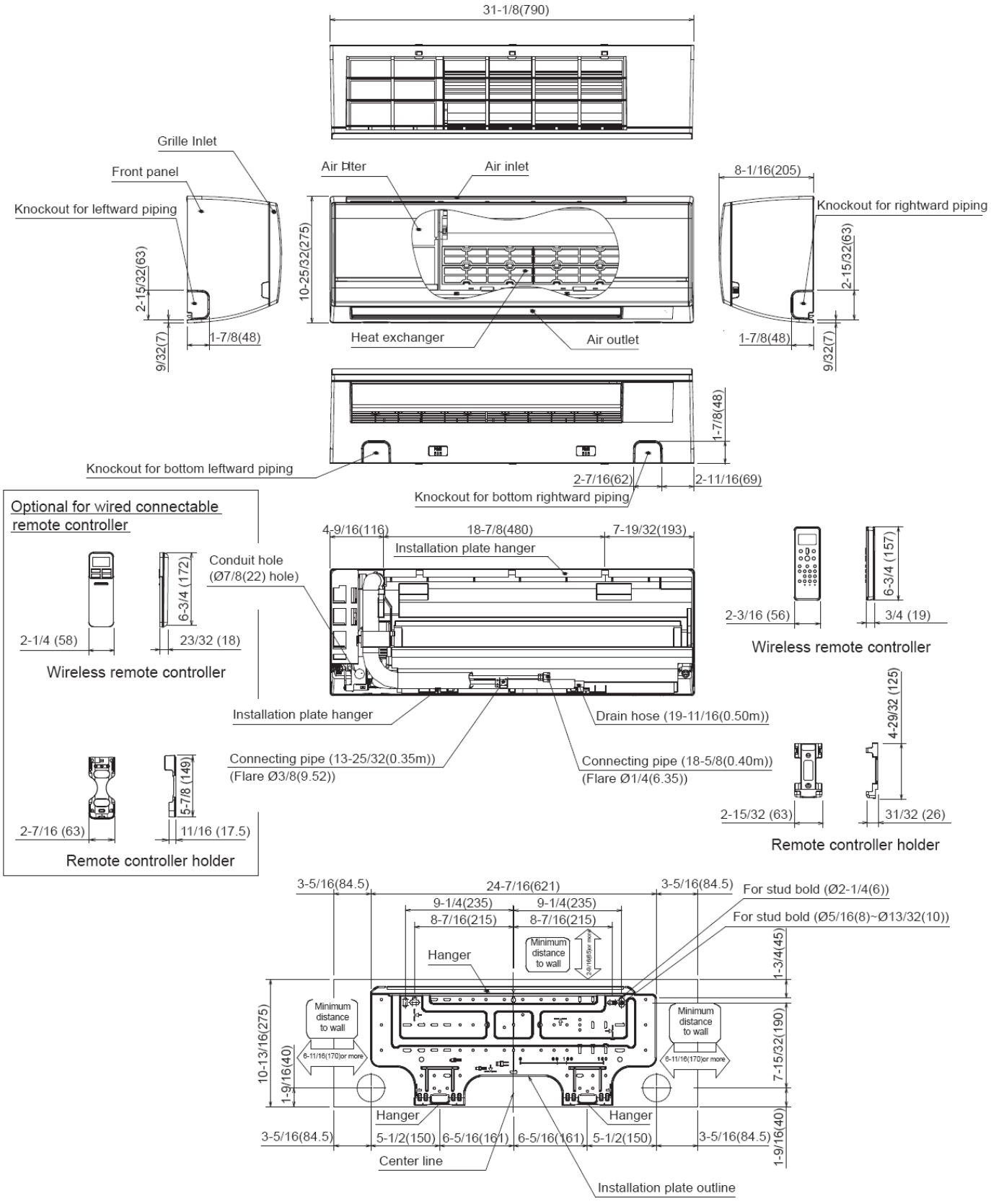
* The specification may be subject to change without notice for purpose of improvement.

Rated conditions Cooling: Indoor air temperature 80°F DB / 67°F WB, Outdoor air temperature 95°F DB
Heating: Indoor air temperature 70°F DB, Outdoor air temperature 47°F DB/ 43°F WB

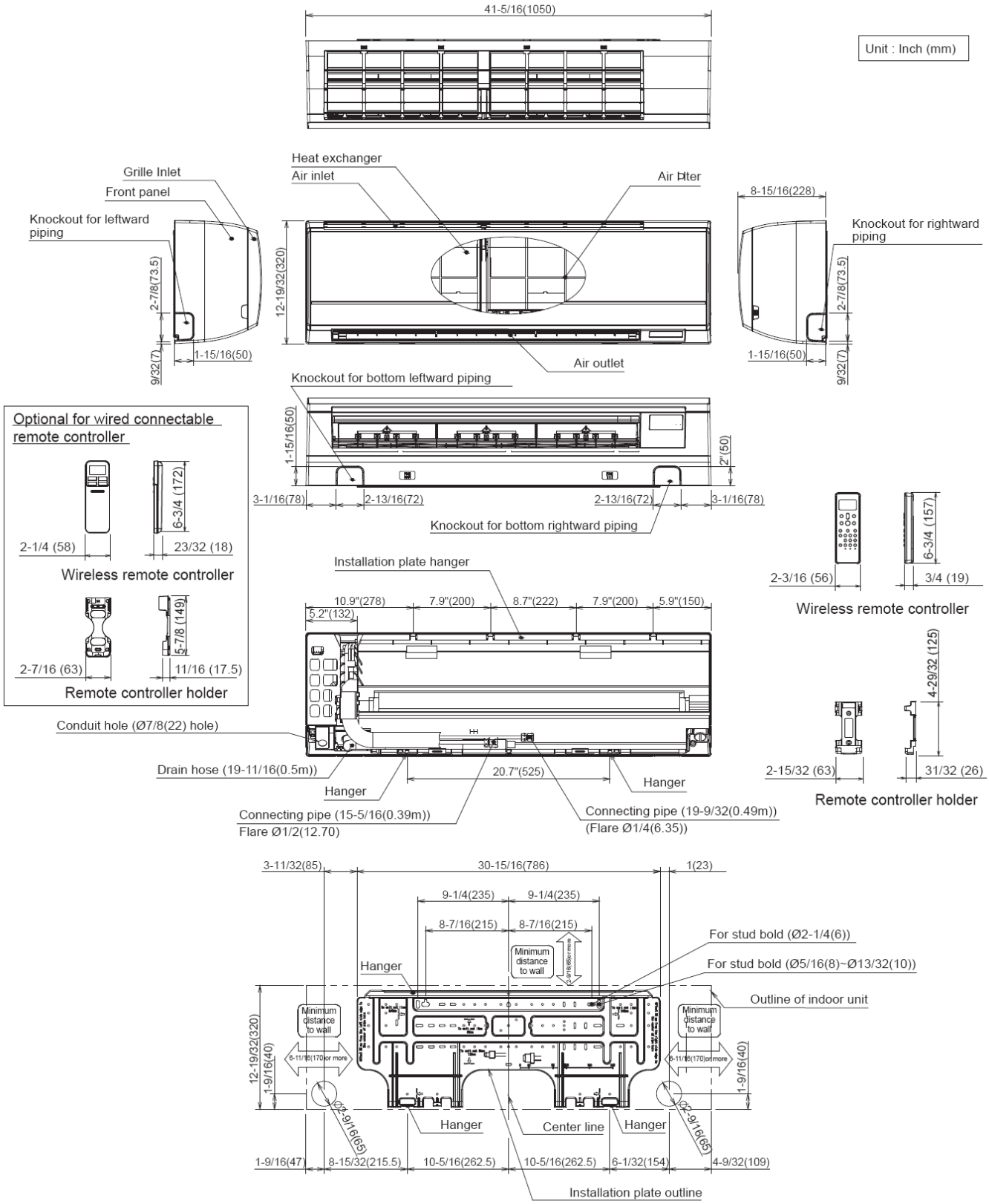
Dimensions of Indoor and outdoor units

Indoor units: RAS-09EKV-UL, RAS-12EKV-UL

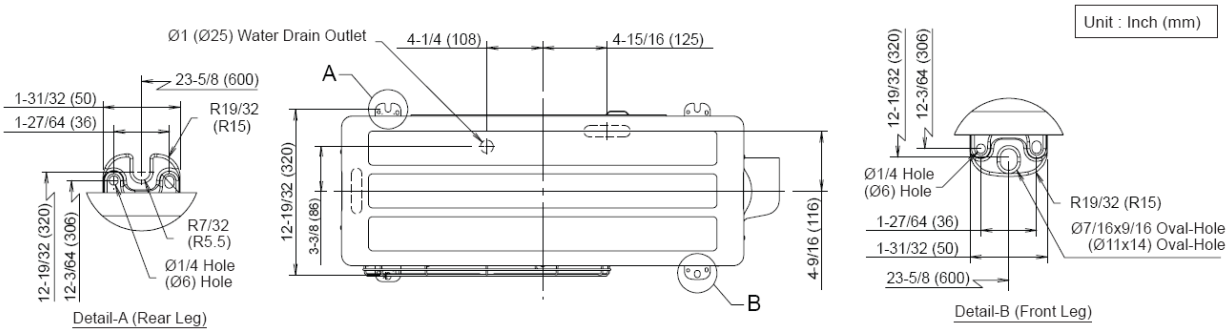
Unit : Inch (mm)

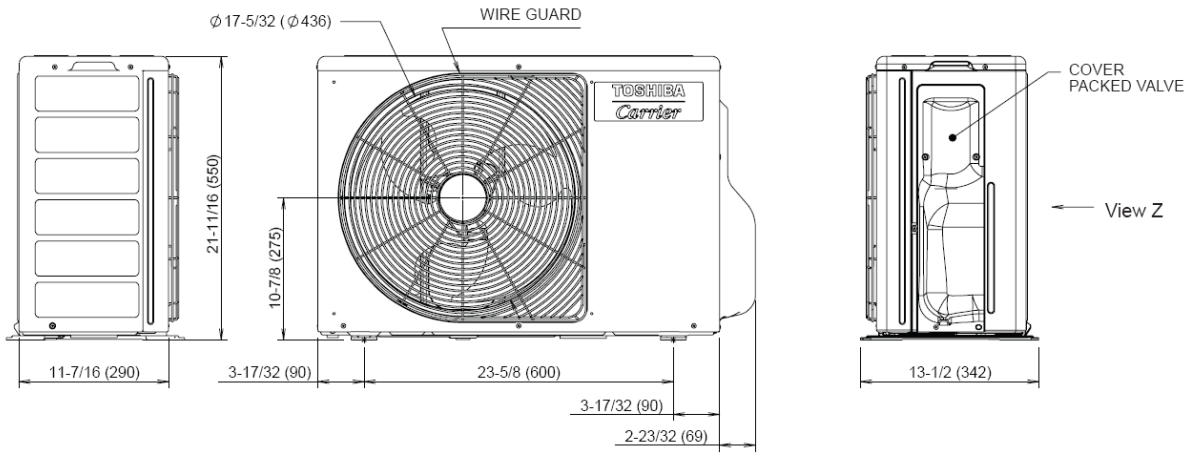


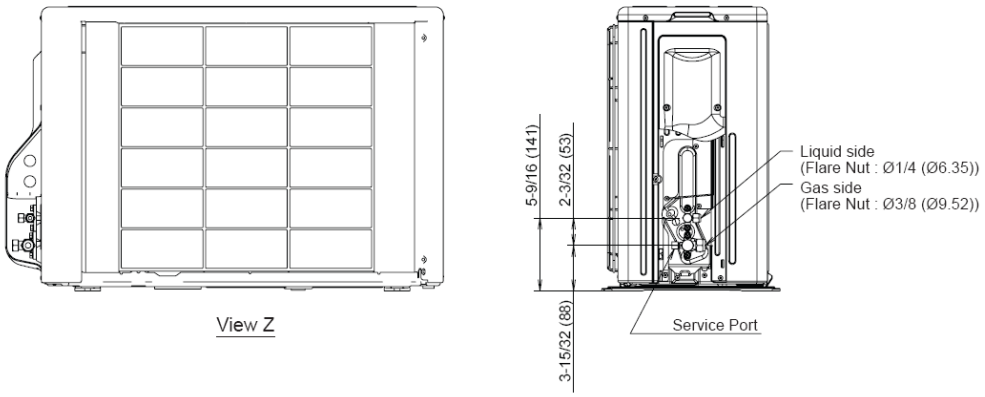
Indoor units: RAS-15EKV-UL, RAS-17EKV-UL, RAS-22EKV-UL

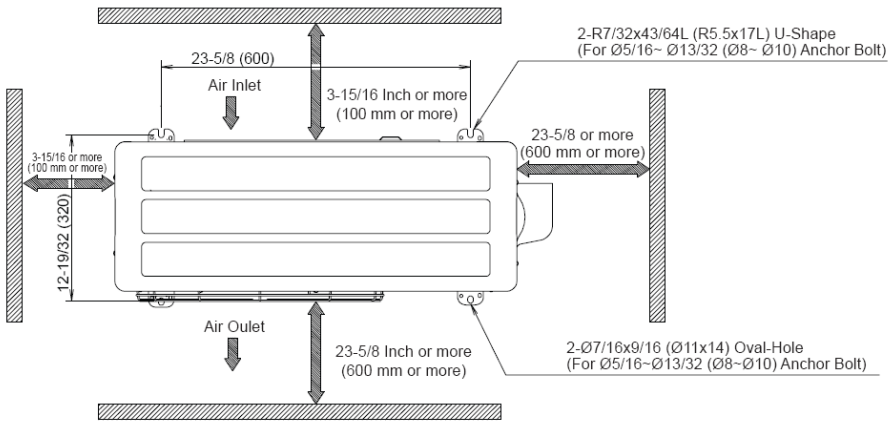


Outdoor units: RAS-09EAV2-UL, RAS-12EAV2-UL, RAS-15EAV2-UL, RAS-17EAV2-UL, RAS-22EAV2-UL








23-5/8 (600)
Air Inlet
3-15/16 Inch or more (100 mm or more)
2-R7/32x43/64L (R5.5x17L) U-Shape (For Ø5/16~ Ø13/32 (Ø8~ Ø10) Anchor Bolt)
23-5/8 or more (600 mm or more)
3-15/16 or more (100 mm or more)
12-19/32 (320)
Air Oulet
23-5/8 Inch or more (600 mm or more)
2-Ø7/16x9/16 (Ø11x14) Oval-Hole (For Ø5/16~Ø13/32 (Ø8~Ø10) Anchor Bolt)

Part load performance

Single Split Type
Indoor: RAS-09EKV-UL
Outdoor: RAS-09EAV2-UL

	Cooling		Heating	
	Q (Btu/h)	W	Q (Btu/h)	W
Minimum	3750	250	3070	170
Rating	9000	690	10800	800

Cooling

OD temp. (°F)		Load (%)									
		100	90	80	70	60	50	40	30	20	10
115	Q (Btu/h)	7730	6957	6184	5411	4638	3865	3221	3221	3221	3221
	W	799	711	624	537	450	362	289	289	289	289
105	Q (Btu/h)	8365	7528	6692	5855	5019	4182	3485	3485	3485	3485
	W	744	663	582	500	419	338	270	270	270	270
95	**Q (Btu/h)**	**9000**	**8100**	**7200**	**6300**	**5400**	**4500**	**3750**	**3750**	**3750**	**3750**
	W	**690**	**615**	**539**	**464**	**388**	**313**	**250**	**250**	**250**	**250**
87	Q (Btu/h)	9520	8568	7616	6664	5712	4760	3967	3967	3967	3967
	W	646	575	504	434	363	293	234	234	234	234
82	Q (Btu/h)	9809	8828	7847	6866	5885	4904	4087	4087	4087	4087
	W	621	553	485	417	349	281	225	225	225	225
75	Q (Btu/h)	10271	9243	8216	7189	6162	5135	4279	4279	4279	4279
	W	581	518	454	391	327	264	211	211	211	211
65	Q (Btu/h)	10906	9815	8725	7634	6543	5453	4544	4544	4544	4544
	W	527	469	412	354	296	239	191	191	191	191
55	Q (Btu/h)	11541	10387	9233	8079	6925	5771	4809	4809	4809	4809
	W	472	421	369	317	266	214	171	171	171	171
45	Q (Btu/h)	12234	11011	9787	8564	7340	6117	5098	5098	5098	5098
	W	413	368	323	278	232	187	150	150	150	150
35	Q (Btu/h)	12869	11582	10295	9008	7722	6435	5362	5362	5362	5362
	W	359	319	280	241	202	163	130	130	130	130
25	Q (Btu/h)	13505	12154	10804	9453	8103	6752	5627	5627	5627	5627
	W	304	271	238	204	171	138	110	110	110	110
15	Q (Btu/h)	14140	12726	11312	9898	8484	7070	5892	5892	5892	5892
	W	250	223	195	168	141	113	91	91	91	91
0	Q (Btu/h)	15122	13609	12097	10585	9073	7561	6301	6301	6301	6301
	W	166	148	130	111	93	75	60	60	60	60

Heating

OD temp. (°F)		Load (%)									
		100	90	80	70	60	50	40	30	20	10
75	Q (Btu/h)	15120	13608	12096	10584	9072	7560	6048	4536	4298	4298
	W	992	883	774	665	555	446	337	228	211	211
68	Q (Btu/h)	14061	12655	11249	9843	8437	7031	5624	4218	3997	3997
	W	945	841	737	633	529	425	321	217	201	201
62	Q (Btu/h)	13085	11777	10468	9160	7851	6543	5234	3926	3720	3720
	W	902	803	704	604	505	406	307	207	192	192
55	Q (Btu/h)	12110	10899	9688	8477	7266	6055	4844	3633	3442	3442
	W	858	764	669	575	480	386	292	197	182	182
47	**Q (Btu/h)**	**10800**	**9720**	**8640**	**7560**	**6480**	**5400**	**4320**	**3240**	**3070**	**3070**
	W	**800**	**712**	**624**	**536**	**448**	**360**	**272**	**184**	**170**	**170**
45	Q (Btu/h)	10438	9394	8350	7307	6263	5219	4175	3131	2967	2967
	W	784	698	611	525	439	353	266	180	167	167
35	Q (Btu/h)	7595	6836	6076	5317	4557	3798	3038	2279	2159	2159
	W	691	615	539	463	387	311	235	159	147	147
25	Q (Btu/h)	6890	6201	5512	4823	4134	3445	2756	2067	1959	1959
	W	638	568	498	427	357	287	217	147	136	136
17	Q (Btu/h)	6313	5682	5050	4419	3788	3157	2525	1894	1795	1795
	W	596	530	465	399	334	268	203	137	127	127
5	Q (Btu/h)	4306	3875	3445	3014	2584	2153	1722	1292	1224	1224
	W	511	455	399	342	286	230	174	117	109	109
0	Q (Btu/h)	3470	3123	2776	2429	2082	1735	1388	1041	986	986
	W	474	422	370	318	265	213	161	109	101	101
-4	Q (Btu/h)	2913	2622	2330	2039	1748	1457	1165	874	828	828
	W	449	400	350	301	251	202	153	103	95	95

Part load performance

Single Split Type
Indoor: RAS-12EKV-UL
Outdoor: RAS-12EAV2-UL

	Cooling		Heating	
	Q (Btu/h)	W	Q (Btu/h)	W
Minimum	2750	150	3070	160
Rating	12000	950	14200	1090

Cooling

OD temp. (°F)		Load (%)									
		100	90	80	70	60	50	40	30	20	10
115	Q (Btu/h)	10306	9275	8245	7214	6184	5153	4122	3092	2362	2362
	W	1100	980	859	739	619	499	379	259	174	174
105	Q (Btu/h)	11153	10038	8922	7807	6692	5577	4461	3346	2556	2556
	W	1025	913	801	689	577	465	353	241	162	162
95	**Q (Btu/h)**	**12000**	**10800**	**9600**	**8400**	**7200**	**6000**	**4800**	**3600**	**2750**	**2750**
	W	**950**	**846**	**742**	**639**	**535**	**431**	**327**	**224**	**150**	**150**
87	Q (Btu/h)	12693	11424	10154	8885	7616	6347	5077	3808	2909	2909
	W	889	792	695	597	500	403	306	209	140	140
82	Q (Btu/h)	13078	11770	10462	9155	7847	6539	5231	3923	2997	2997
	W	855	761	668	575	481	388	294	201	135	135
75	Q (Btu/h)	13694	12325	10955	9586	8216	6847	5478	4108	3138	3138
	W	800	713	625	538	451	363	276	188	126	126
65	Q (Btu/h)	14541	13087	11633	10179	8725	7271	5816	4362	3332	3332
	W	725	646	567	488	408	329	250	171	115	115
55	Q (Btu/h)	15388	13849	12310	10772	9233	7694	6155	4616	3526	3526
	W	650	579	508	437	366	295	224	153	103	103
45	Q (Btu/h)	16312	14681	13050	11418	9787	8156	6525	4894	3738	3738
	W	569	507	444	382	320	258	196	134	90	90
35	Q (Btu/h)	17159	15443	13727	12011	10295	8580	6864	5148	3932	3932
	W	494	440	386	332	278	224	170	116	78	78
25	Q (Btu/h)	18006	16205	14405	12604	10804	9003	7202	5402	4126	4126
	W	419	373	327	282	236	190	144	99	66	66
15	Q (Btu/h)	18853	16968	15082	13197	11312	9427	7541	5656	4320	4320
	W	344	306	269	231	194	156	119	81	54	54
0	Q (Btu/h)	20162	18146	16130	14113	12097	10081	8065	6049	4620	4620
	W	228	203	178	153	129	104	79	54	36	36

Heating

OD temp. (°F)		Load (%)									
		100	90	80	70	60	50	40	30	20	10
75	Q (Btu/h)	19980	17892	15904	13916	11928	9940	7952	5964	4298	4298
	W	1352	1205	1058	910	763	616	469	322	198	198
68	Q (Btu/h)	18487	16638	14790	12941	11092	9244	7395	5546	3997	3997
	W	1287	1147	1007	867	727	587	446	306	189	189
62	Q (Btu/h)	17205	15485	13764	12044	10323	8603	6882	5162	3720	3720
	W	1228	1094	961	827	693	560	426	292	180	180
55	Q (Btu/h)	15922	14330	12738	11145	9553	7961	6369	4777	342	342
	W	1169	1042	914	787	660	533	405	278	172	172
47	**Q (Btu/h)**	**14200**	**12780**	**11360**	**9940**	**8520**	**7100**	**5680**	**4260**	**3070**	**3070**
	W	**1090**	**971**	**853**	**734**	**615**	**497**	**378**	**259**	**160**	**160**
45	Q (Btu/h)	13724	12352	10979	9607	8234	6862	5490	4117	2967	2967
	W	1068	952	835	719	603	487	370	254	157	157
35	Q (Btu/h)	9986	8987	7989	6990	5992	4993	3994	2996	2159	2159
	W	941	839	736	634	531	429	326	224	138	138
25	Q (Btu/h)	9059	8153	7247	6341	5435	4530	3624	2718	1959	1959
	W	870	775	681	586	491	396	302	207	128	128
17	Q (Btu/h)	8301	7471	6641	5811	4981	4151	3320	2490	1795	1795
	W	812	724	635	547	458	370	282	193	119	119
5	Q (Btu/h)	5662	5096	4530	3963	3397	2831	2265	1699	1224	1224
	W	697	621	545	469	394	318	242	166	102	102
0	Q (Btu/h)	4562	4106	3650	3193	2737	2281	1825	1369	986	986
	W	646	576	505	435	365	294	224	154	95	95
-4	Q (Btu/h)	3829	3446	3063	2680	2297	1915	1532	1149	828	828
	W	612	545	479	412	346	279	212	146	90	90

Part load performance

Single Split Type
Indoor: RAS-15EKV-UL
Outdoor: RAS-15EAV2-UL

	Cooling		Heating	
	Q (Btu/h)	W	Q (Btu/h)	W
Minimum	2750	160	2750	143
Rating	15000	1150	18000	1400

Cooling

OD temp.		Load (%)									
(°F)		100	90	80	70	60	50	40	30	20	10
115	Q (Btu/h)	12883	11594	10306	9018	7730	6441	5153	3865	2577	2362
	W	1331	1191	1051	910	770	630	489	349	209	185
105	Q (Btu/h)	13941	12547	11153	9759	8365	6971	5577	4182	2788	2556
	W	1241	1110	979	848	718	587	456	325	194	173
95	**Q (Btu/h)**	**15000**	**13500**	**12000**	**10500**	**9000**	**7500**	**6000**	**4500**	**3000**	**2750**
	W	**1150**	**1029**	**908**	**786**	**665**	**544**	**423**	**301**	**180**	**160**
87	Q (Btu/h)	15866	14280	12693	11106	9520	7933	6347	4760	3173	2909
	W	1076	962	849	736	622	509	395	282	169	150
82	Q (Btu/h)	16348	14713	13078	11443	9809	8174	6539	4904	3270	2997
	W	1035	926	816	707	598	489	380	271	162	144
75	Q (Btu/h)	17118	15406	13694	11982	10271	8559	6847	5135	3424	3138
	W	969	867	764	662	560	458	356	254	152	135
65	Q (Btu/h)	18176	16359	14541	12723	10906	9088	7271	5453	3635	3332
	W	878	785	693	600	508	415	323	230	138	122
55	Q (Btu/h)	19235	17312	15388	13465	11541	9618	7694	5771	3847	3526
	W	787	704	621	538	455	372	289	206	123	110
45	Q (Btu/h)	20390	18351	16312	14273	12234	10195	8156	6117	4078	3738
	W	688	616	543	471	398	326	253	180	108	96
35	Q (Btu/h)	21449	19304	17159	15014	12869	10724	8580	6435	4290	3932
	W	598	535	472	409	346	283	220	157	94	83
25	Q (Btu/h)	22508	20257	18006	15755	13505	11254	9003	6752	4502	4126
	W	507	454	400	347	293	240	186	133	79	71
15	Q (Btu/h)	23566	21210	18853	16496	14140	11783	9427	7070	4713	4320
	W	416	373	329	285	241	197	153	109	65	58
0	Q (Btu/h)	25203	22682	20162	17642	15122	12601	10081	7561	5041	4620
	W	276	247	218	189	160	131	102	72	43	38

Heating

OD temp.		Load (%)									
(°F)		100	90	80	70	60	50	40	30	20	10
75	Q (Btu/h)	25200	22680	20160	17640	15120	12600	10080	7560	500	3850
	W	1736	1552	1368	1184	1000	816	632	448	264	177
68	Q (Btu/h)	23435	21092	1874	16405	14061	11718	9374	7031	4687	3580
	W	1654	1479	1303	1128	953	778	602	427	252	169
62	Q (Btu/h)	21805	19625	17444	15264	13083	10903	8722	6542	4361	3331
	W	1578	1411	1244	1076	909	724	575	407	240	161
55	Q (Btu/h)	20183	18165	16146	14128	12110	10092	8073	6055	4037	3084
	W	1502	1343	1184	1024	865	706	547	388	229	153
47	Q (Btu/h)	**18000**	**16200**	**14400**	**12600**	**10800**	**9000**	**7200**	**5400**	**3600**	**2750**
	W	**1400**	**1252**	**1103**	**955**	**807**	**658**	**510**	**361**	**213**	**143**
45	Q (Btu/h)	17396	15656	13917	12177	10438	8698	6958	5219	3479	2658
	W	1372	1227	1081	936	790	645	500	354	209	140
35	Q (Btu/h)	12659	11393	10127	8861	7595	6330	5064	3798	2532	1934
	W	1209	1081	953	825	696	568	440	312	184	123
25	Q (Btu/h)	11484	10336	9187	8035	6890	5742	4594	3445	2297	1755
	W	1117	999	880	762	643	525	407	288	170	114
17	Q (Btu/h)	10522	9470	8418	7365	6313	5261	4209	3157	2104	1608
	W	102	932	821	711	600	490	379	269	159	106
5	Q (Btu/h)	7177	6459	5742	5024	4306	3580	2871	2153	1435	1096
	W	895	800	705	610	516	421	326	231	136	91
0	Q (Btu/h)	5783	5205	4626	4048	3470	2892	2313	1735	1157	884
	W	830	742	654	566	478	390	302	214	126	85
-4	Q (Btu/h)	4854	4369	3883	3398	2912	2427	1942	1453	971	742
	W	787	704	620	537	453	370	287	203	120	80

Part load performance

Single Split Type
Indoor: RAS-17EKV-UL
Outdoor: RAS-17EAV2-UL

	Cooling		Heating	
	Q (Btu/h)	W	Q (Btu/h)	W
Minimum	3750	190	2750	150
Rating	16200	1285	20200	1630

Cooling

OD temp. (°F)		Load (%)									
		100	90	80	70	60	50	40	30	20	10
115	Q (Btu/h)	13913	12522	11130	9739	8348	6957	5565	4174	3221	3221
	W	1488	1323	1158	993	828	663	498	333	220	220
105	Q (Btu/h)	15057	13551	12045	10540	9034	7528	6023	4517	3485	3485
	W	1386	1233	1079	925	771	618	464	310	205	205
95	**Q (Btu/h)**	**16200**	**14580**	**12960**	**11340**	**9720**	**8100**	**6480**	**4860**	**3750**	**3750**
	W	**1285**	**1143**	**1000**	**858**	**715**	**573**	**430**	**288**	**190**	**190**
87	Q (Btu/h)	17136	15422	13708	11995	10281	8568	6854	5141	3967	3967
	W	1202	1069	936	802	669	536	402	269	178	178
82	Q (Btu/h)	17655	15890	14124	12359	10593	8828	7062	5297	4087	4087
	W	1156	1028	900	772	643	515	387	259	171	171
75	Q (Btu/h)	18487	16638	14790	12941	11092	9243	7395	5546	4279	4279
	W	1082	962	842	722	602	482	362	242	160	160
65	Q (Btu/h)	19630	17667	15704	13741	11778	9815	7852	5889	4544	4544
	W	981	872	764	655	546	437	328	220	145	145
55	Q (Btu/h)	20774	18696	16619	14542	12464	10387	8310	6232	4809	4809
	W	880	782	685	587	490	392	294	197	130	130
45	Q (Btu/h)	22021	19819	17617	15415	13213	11011	8808	6606	5098	5098
	W	769	684	599	513	428	343	257	172	114	114
35	Q (Btu/h)	23165	20848	18532	16215	13899	11582	9266	6949	5362	5362
	W	668	594	520	446	372	298	224	150	99	99
25	Q (Btu/h)	24308	21877	19446	17016	14585	12154	9723	7292	5627	5627
	W	567	504	441	378	315	253	190	127	84	84
15	Q (Btu/h)	25452	22906	20361	17816	15271	12726	10181	7635	5892	5892
	W	465	414	362	311	259	207	156	104	69	69
0	Q (Btu/h)	27219	24497	21775	19053	16331	13609	10887	8166	6301	6301
	W	309	275	240	206	172	138	103	69	46	46

Heating

OD temp. (°F)		Load (%)									
		100	90	80	70	60	50	40	30	20	10
75	Q (Btu/h)	28280	25452	22624	19796	16968	14140	11312	8484	5656	3850
	W	2021	1809	1596	1384	1171	959	746	534	322	186
68	Q (Btu/h)	26299	23669	21039	18409	15779	13150	10520	7890	5260	3580
	W	1925	1723	1520	1318	1116	913	711	509	306	177
62	Q (Btu/h)	24475	22028	19580	17133	14685	12238	9790	7343	4895	3332
	W	1837	1644	1451	1258	1065	872	679	485	292	169
55	Q (Btu/h)	22650	20385	18120	15855	13590	11325	9060	6795	4530	3084
	W	1749	1565	1381	1198	1014	830	646	462	278	161
47	**Q (Btu/h)**	**20200**	**18180**	**16160**	**14140**	**12120**	**10100**	**8080**	**6060**	**4040**	**2750**
	W	**1630**	**1459**	**1287**	**1116**	**945**	**773**	**602**	**431**	**259**	**150**
45	Q (Btu/h)	19522	17570	15618	13665	11713	9761	7809	5857	3904	2658
	W	1597	1429	1261	1093	926	758	590	422	254	147
35	Q (Btu/h)	14206	12785	11365	9944	8524	7103	5682	4262	2841	1934
	W	1408	1260	1112	964	816	668	520	372	224	130
25	Q (Btu/h)	12887	11598	10310	9021	7732	6444	5155	3866	2577	1754
	W	1301	1164	1028	891	754	617	481	344	207	120
17	Q (Btu/h)	11808	10627	9446	8266	7085	5904	4723	3542	2362	1608
	W	1214	1086	959	831	704	576	448	321	193	112
5	Q (Btu/h)	8054	7249	6443	5638	4832	4027	3222	2416	1611	1096
	W	1042	932	823	713	604	494	385	275	166	96
0	Q (Btu/h)	6490	5841	5192	4543	3894	3245	2596	1947	1298	884
	W	966	864	763	661	560	458	357	255	154	89
-4	Q (Btu/h)	5447	4902	4358	3813	3268	2724	2179	1634	1089	742
	W	916	820	723	627	531	435	338	242	146	84

Part load performance

Single Split Type
Indoor: RAS-22EKV-UL
Outdoor: RAS-22EAV2-UL

	Cooling		Heating	
	Q (Btu/h)	W	Q (Btu/h)	W
Minimum	4100	210	3450	190
Rating	21400	2570	23200	2200

Cooling

OD temp.		Load (%)									
(°F)		100	90	80	70	60	50	40	30	20	10
115	Q (Btu/h)	10549	9494	8439	7384	6330	5275	4220	3165	2110	2021
	W	1908	1691	1474	1257	1041	824	607	391	174	156
105	Q (Btu/h)	17227	15504	13781	12059	10336	8613	6891	5168	3445	3300
	W	2409	2136	1862	1588	1315	1041	767	494	220	197
95	**Q (Btu/h)**	**21400**	**19260**	**17120**	**14980**	**12840**	**10700**	**8560**	**6420**	**4280**	**4100**
	W	**2570**	**2278**	**1986**	**1694**	**1402**	**1110**	**818**	**526**	**235**	**210**
87	Q (Btu/h)	22636	20372	18109	15845	13582	11318	9054	6791	4527	4337
	W	2404	2131	1858	1585	1312	1039	766	493	219	196
82	Q (Btu/h)	23322	20990	18658	16326	13993	11661	9329	6997	4664	4468
	W	2312	2050	1787	1524	1262	999	736	474	211	189
75	Q (Btu/h)	24421	21979	19537	17095	14653	12210	9768	7326	4884	4679
	W	2165	1919	1673	1427	1181	935	689	443	198	177
65	Q (Btu/h)	25931	23338	20745	18152	15559	12966	10373	7779	5186	4968
	W	1962	1739	1516	1294	1071	848	625	402	179	160
55	Q (Btu/h)	27442	24698	21954	19209	16465	13721	10977	8233	5488	5258
	W	1760	1560	1360	1160	960	760	560	360	161	144
45	Q (Btu/h)	29090	26181	23272	20363	17454	14545	11636	8727	5818	5573
	W	1539	1364	1189	1014	839	665	490	315	140	126
35	Q (Btu/h)	30600	27540	24480	21420	18360	15300	12240	9180	6120	5863
	W	1336	1184	1032	881	729	577	425	274	122	109
25	Q (Btu/h)	32111	28900	25689	22477	19266	16055	12844	9633	6422	6152
	W	1133	1005	876	747	618	490	361	232	103	93
15	Q (Btu/h)	33621	30259	26897	23535	20173	16811	13448	10086	6724	6441
	W	931	825	719	614	508	402	296	191	85	76
0	Q (Btu/h)	35956	32360	28764	25169	21573	17978	14382	10787	7191	6889
	W	618	547	477	407	337	267	197	127	56	50

Heating

OD temp.		Load (%)									
(°F)		100	90	80	70	60	50	40	30	20	10
75	Q (Btu/h)	32480	29232	25984	22736	19488	16240	12992	9744	6496	4830
	W	2728	2435	2142	1850	1557	1264	971	679	386	236
68	Q (Btu/h)	30205	27185	24164	2114	18123	15103	12082	9062	6041	4492
	W	2599	2320	2041	1762	1483	1204	925	646	368	224
62	Q (Btu/h)	28109	25298	22487	19676	16865	14055	11244	8433	5622	4180
	W	2479	2213	1947	1681	1415	1149	883	617	351	214
55	Q (Btu/h)	26014	23413	20811	18210	15608	13007	10406	7804	5203	3868
	W	2360	2107	1853	1600	1347	1094	840	587	334	204
47	**Q (Btu/h)**	**23200**	**20880**	**18560**	**16240**	**13920**	**11600**	**9280**	**6960**	**4640**	**3450**
	W	**2200**	**1964**	**1728**	**1492**	**1256**	**1019**	**783**	**547**	**311**	**190**
45	Q (Btu/h)	22422	20180	17938	15695	13453	11211	8969	6727	4484	3334
	W	2156	1925	1693	1462	1230	999	768	536	305	186
35	Q (Btu/h)	16316	14684	13053	11421	9790	8158	6526	4895	3263	2426
	W	1900	1696	1492	1288	1084	880	677	473	269	164
25	Q (Btu/h)	14801	13321	11841	10361	8881	7401	5920	4440	2960	2201
	W	1756	1568	1379	1191	1002	814	625	437	248	152
17	Q (Btu/h)	13562	12206	10850	9493	8137	6781	5425	4069	2712	2017
	W	1638	1462	1286	1111	935	759	583	407	232	141
5	Q (Btu/h)	9250	8325	7400	6475	5550	4625	3700	2775	1850	1376
	W	1406	1255	1104	953	802	652	501	350	199	121
0	Q (Btu/h)	7454	6709	5963	5218	4472	3727	2982	2236	1491	1108
	W	1304	1164	1024	884	744	604	464	324	184	113
-4	Q (Btu/h)	6257	5631	5006	4380	3754	3129	2503	1877	1251	930
	W	1236	1103	971	838	705	573	440	307	175	107

Sensible capacity table

Trend of Total & Sensible Heat Capacity / Indoor Air & Outdoor Air Temperature.

Product models: **RAS-09EKV-UL / RAS-09EAV2-UL**

Standard condition

Indoor	80.0°F DB / 67.0°F WB
Outdoor	95.0°F DB / 75.0°F WB

Specification of product at standard condition.

Total Cooling Capacity (TC)	9000 Btu/h
Sensible Heat Capacity (SHC)	6990 Btu/h
Air flow volume	303 CFM

	Indoor coil air temperature															
Outdoor	68.0°F DB		73.0°F DB		75.0°F DB		79.0°F DB		80.0°F DB		82.0°F DB		86.0°F DB		90.0°F DB	
coil air temp.	57.0°F WB		61.0°F WB		63.0°F WB		64.0°F WB		67.0°F WB		68.0°F WB		72.0°F WB		75.0°F WB	
°F DB	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC
0	12421	10402	13717	11079	14042	11313	14689	11776	15122	11744	15554	11727	16472	11594	17228	11346
5	12136	10164	13402	10825	13720	11054	14352	11506	14775	11475	15198	11458	16094	11328	16833	11086
10	11852	9925	13088	10571	13398	10795	14016	11236	14429	11206	14841	11190	15717	11063	16438	10826
15	11614	9727	12826	10359	13130	10579	13735	11011	14140	10982	14544	10966	15402	10841	16109	10609
20	11330	9488	12512	10105	12808	10319	13399	10741	13793	10713	14188	10696	15025	10576	15715	10349
25	11093	9290	12250	9894	12540	10103	13118	10516	13505	10488	13891	10473	14710	10354	15386	10132
30	10808	9051	11936	9640	12219	9844	12782	10247	13158	10219	13534	10204	14333	10089	14991	9873
35	10571	8853	11674	9428	11950	9628	12501	10022	12869	9995	13237	9980	14018	9867	14662	9656
40	10286	8614	11359	9175	11629	9369	12165	9752	12523	9726	12881	9712	13641	9601	14267	9396
45	10049	8416	11097	8963	11360	9153	11884	9527	12234	9502	12584	9488	13326	9380	13938	9179
50	9764	8177	10783	8709	11039	8894	11548	9257	11888	9233	12227	9219	12949	9114	13543	8919
55	9480	7939	10469	8455	10717	8634	11211	8987	11541	8964	11871	8950	12572	8849	13149	8659
60	9243	7740	10207	8244	10449	8418	10930	8763	11252	8739	11574	8726	12257	8627	12820	8443
65	8958	7502	9893	7990	10127	8159	10594	8493	10906	8470	11218	8458	11880	8362	12425	8183
70	8721	7303	9631	7778	9859	7943	10313	8268	10617	8246	10921	8234	11565	8140	12096	7966
75	8436	7065	9316	7525	9537	7684	9977	7998	10271	7977	10564	7965	11188	7875	11701	7706
80	8199	6866	9054	7313	9269	7468	9696	7773	9982	7752	10267	7741	10873	7653	11372	7489
82	8057	6747	8897	7186	9108	7338	9528	7638	9809	7618	10089	7607	10684	7520	11175	7359
85	7914	6628	8740	7059	8947	7209	9360	7503	9635	7483	9911	7472	10496	7388	10977	7229
87	7820	6549	8635	6974	8840	7122	9247	7413	9520	7394	9792	7383	10370	7299	10846	7143
90	7677	6429	8478	6848	8679	6993	9079	7278	9347	7259	9614	7248	10181	7166	10648	7013
95	7393	6191	8164	6594	8357	6733	8743	7009	9000	6990	9257	6980	9804	6900	10254	6753
100	7108	5953	7850	6340	8036	6474	8406	6739	8654	6721	8901	6711	9426	6635	9859	6493
105	6871	5754	7588	6128	7768	6258	8126	6514	8365	6497	8604	6487	9112	6413	9530	6276
110	6586	5516	7273	5874	7446	5999	7789	6244	8018	6228	8248	6218	8734	6148	9135	6016
115	6349	5317	7011	5663	7178	5783	7508	6019	7730	6003	7951	5994	8420	5926	8806	5799

Trend of Total & Sensible Heat Capacity / Indoor Air & Outdoor Air Temperature.

Product models: **RAS-12EKV-UL / RAS-12EAV2-UL**

Standard condition

Indoor	80.0°F DB / 67.0°F WB
Outdoor	95.0°F DB / 75.0°F WB

Specification of product at standard condition.

Total Cooling Capacity (TC)	12000 Btu/h
Sensible Heat Capacity (SHC)	9216 Btu/h
Air flow volume	406 CFM

	Indoor coil air temperature															
Outdoor	68.0°F DB		73.0°F DB		75.0°F DB		79.0°F DB		80.0°F DB		82.0°F DB		86.0°F DB		90.0°F DB	
coil air temp.	57.0°F WB		61.0°F WB		63.0°F WB		64.0°F WB		67.0°F WB		68.0°F WB		72.0°F WB		75.0°F WB	
°F DB	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC
0	16561	13726	18289	14613	18722	14922	19585	15531	20162	15484	20739	15457	21962	15268	22971	14929
5	16182	13411	17870	14278	18293	14580	19137	15175	19700	15130	20263	15102	21459	14918	22444	14586
10	15802	13097	17451	13943	17864	14238	18688	14819	19238	14775	19788	14748	20956	14569	21918	14244
15	15486	12835	17102	13664	17507	13953	18314	14523	18853	14479	19392	14453	20537	14277	21479	13959
20	15106	12520	16682	13329	17078	13611	17865	14167	18391	14124	18917	14099	20033	13927	20953	13617
25	14790	12258	16333	13050	16720	13326	17491	13870	18006	13829	18521	13804	19614	13636	20514	13332
30	14411	11944	15914	12715	16291	12984	17042	13514	17544	13474	18046	13450	19111	13286	19988	12990
35	14094	11681	15565	12436	15934	12699	16668	13218	17159	13178	17650	13154	18691	12994	19549	12705
40	13715	11367	15146	12102	15505	12357	16219	12862	16697	12823	17175	12800	18188	12644	19023	12363
45	13399	11105	14797	11822	15147	12072	15845	12565	16312	12528	16779	12505	17769	12353	18584	12078
50	13019	10790	14378	11488	14718	11730	15397	12210	15850	12173	16303	12151	17265	12003	18058	11736
55	12640	10426	13958	11153	14289	11389	14948	11854	15388	11818	15828	11797	16762	11653	17532	11394
60	12323	10214	13609	10874	13932	11104	14574	11557	15003	11522	15432	11502	16343	11361	17093	11109
65	11944	9899	13190	10539	13503	10762	14125	11201	14541	11167	14957	11147	15840	11012	16567	10767
70	11628	9637	12841	10260	13145	10477	13751	10905	14156	10872	14561	10852	15420	10720	16128	10482
75	11248	9323	12422	9925	12716	10135	13302	10549	13694	10517	14086	10498	14917	10370	15602	10139
80	10932	9060	12073	9646	12359	9850	12928	10252	13309	10221	13690	10203	14497	10079	15163	9854
82	10742	8903	11863	9479	12144	9679	12704	10074	13078	10044	13452	10026	14246	9904	14900	9683
85	10553	8746	11654	9311	11930	9508	12480	9896	12847	9866	13214	9849	13994	9729	14637	9512
87	10426	8641	11514	9200	11787	9394	12330	9778	12693	9748	13056	9731	13826	9612	14461	9398
90	10236	8484	11304	9032	11572	9223	12106	9600	12462	9571	12818	9554	13575	9437	14198	9227
95	9857	8169	10885	8697	11143	8881	11657	9244	12000	9216	12343	9199	13072	9087	13672	8885
100	9477	7855	10466	8362	10714	8539	11208	8888	11538	8861	11868	8845	12568	8738	13145	8543
105	9161	7593	10117	8083	10357	8254	10834	8591	11153	8566	11472	8550	12149	8446	12707	8258
110	8782	7278	9698	7749	9928	7912	10385	8235	10691	8211	10997	8196	11646	8096	12180	7916
115	8465	7016	9349	7470	9570	7627	10011	7939	10306	7915	10601	7901	11226	7805	11742	7631

Sensible capacity table

Trend of Total & Sensible Heat Capacity / Indoor Air & Outdoor Air Temperature.

Product models: **RAS-15EKV-UL / RAS-15EAV2-UL**

Standard condition

Indoor	80.0°F DB / 67.0°F WB
Outdoor	95.0°F DB / 75.0°F WB

Specification of product at standard condition.

Total Cooling Capacity (TC)	15000 Btu/h
Sensible Heat Capacity (SHC)	12510 Btu/h
Air flow volume	562 CFM

	Indoor coil air temperature															
Outdoor coil air temp.	68.0°F DB 57.0°F WB		73.0°F DB 61.0°F WB		75.0°F DB 63.0°F WB		79.0°F DB 64.0°F WB		80.0°F DB 67.0°F WB		82.0°F DB 68.0°F WB		86.0°F DB 72.0°F WB		90.0°F DB 75.0°F WB	
°F DB	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC
0	20701	18524	22861	19775	23403	20197	24482	21030	25203	21019	25923	21032	27453	20897	28713	20556
5	20227	18099	22337	19322	22867	19734	23921	20548	24625	20537	25329	20550	26824	20418	28055	20085
10	19753	17675	21813	18869	22331	19271	23360	20066	24048	20056	24735	20068	26195	19940	27397	19614
15	19357	17321	21377	18491	21884	18886	22892	19664	23566	19654	24240	19666	25671	19541	26849	19221
20	18883	16896	20853	18038	21347	18423	22331	19183	22989	19173	23646	19184	25042	19062	26191	18750
25	18488	16543	20417	17660	20900	18037	21864	18781	22508	18771	23151	18783	24517	18663	25643	18358
30	18013	16118	19893	17207	20364	17574	21303	18299	21930	18290	22557	18301	23888	18184	24985	17887
35	17618	15765	19456	16830	19917	17189	20835	17898	21449	17888	22062	17899	23364	17785	24437	17494
40	17144	15340	18932	16376	19381	16726	20274	17416	20871	17407	21468	17417	22735	17306	23779	17023
45	16748	14986	18496	15999	18934	16340	19807	17014	20390	17005	20973	17017	22211	16907	23230	16631
50	16274	14562	17972	15546	18398	15877	19246	16532	19813	16524	20379	16534	21582	16428	22572	16160
55	15800	14138	17448	15093	17862	15415	18685	16050	19235	16042	19785	16052	20953	15949	21914	15689
60	15404	13784	17012	14715	17415	15029	18217	15649	18754	15641	19290	15650	20428	15550	21366	15296
65	14930	13359	16488	14262	16878	14566	17656	15167	18176	15159	18696	15168	19799	15071	20708	14825
70	14535	13006	16051	13884	16432	14180	17189	14765	17695	14758	18201	14767	19275	14672	20160	14432
75	14060	12581	15527	13431	15895	13718	16628	14283	17118	14276	17607	14285	18646	14193	19502	13961
80	13665	12227	15091	13053	15448	13332	16160	13882	16636	13875	17112	13883	18122	13794	18954	13569
82	13428	12015	14829	12827	15180	13101	15880	13641	16348	13634	16815	13642	17807	13555	18625	13333
85	13191	11803	14567	12600	14912	12869	15599	13400	16059	13393	16518	13401	17493	13316	18296	13098
87	13033	11662	14392	12449	14733	12715	15412	13239	15866	13232	16320	13240	17283	13156	18076	12941
90	12795	11449	14130	12223	14465	12484	15132	12998	15578	12992	16023	12999	16969	12916	17747	12705
95	12321	11025	13607	11770	13929	12021	14571	12516	15000	12510	15429	12518	16340	12438	17090	12234
100	11847	10600	13083	11316	13393	11558	14010	12035	14423	12028	14835	12036	15710	11959	16432	11763
105	11451	10247	12646	10939	12946	11172	13543	11633	13941	11627	14340	11634	15186	11560	15883	11371
110	10927	9822	12122	10486	12410	10709	12982	11151	13364	11145	13746	11152	14557	11081	15225	10900
115	10582	9468	11686	10108	11963	10324	12514	10750	12883	10744	13251	10750	14033	10682	14677	10507

Trend of Total & Sensible Heat Capacity / Indoor Air & Outdoor Air Temperature.

Product models: **RAS-17EKV-UL / RAS-17EAV2-UL**

Standard condition

Indoor	80.0°F DB / 67.0°F WB
Outdoor	95.0°F DB / 75.0°F WB

Specification of product at standard condition.

Total Cooling Capacity (TC)	16200 Btu/h
Sensible Heat Capacity (SHC)	13580 Btu/h
Air flow volume	636 CFM

	Indoor coil air temperature															
Outdoor coil air temp.	68.0°F DB 57.0°F WB		73.0°F DB 61.0°F WB		75.0°F DB 63.0°F WB		79.0°F DB 64.0°F WB		80.0°F DB 67.0°F WB		82.0°F DB 68.0°F WB		86.0°F DB 72.0°F WB		90.0°F DB 75.0°F WB	
°F DB	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC
0	22357	20101	24690	21462	25275	21921	26440	22825	27219	22817	27997	22834	29649	22696	31010	22333
5	21845	19640	24124	20971	24696	21418	25834	22302	26595	22294	27356	22310	28970	22176	30300	21821
10	21333	19180	23559	20479	24117	20916	25229	21779	25971	21771	26714	21787	28291	21656	29589	21309
15	20906	18796	23087	20069	23634	20497	24724	21343	25452	21335	26179	21351	27724	21222	28997	20883
20	20394	18335	22521	19577	23055	19995	24118	20820	24828	20812	25538	20828	27045	20702	28286	20371
25	19967	17951	22050	19167	22573	19576	23613	20384	24308	20377	25003	20392	26479	20269	27694	19945
30	19454	17491	21484	18676	21993	19074	23007	19861	23684	19854	24362	19869	25799	19749	26984	19433
35	19027	17107	21013	18266	21511	18656	22502	19425	23165	19418	23827	19433	25233	19315	26391	19006
40	18515	16646	20447	17774	20932	18153	21896	18902	22541	18895	23186	18910	24554	18795	25681	18495
45	18088	16263	19975	17364	20449	17735	21391	18467	22021	18460	22651	18474	23988	18362	25089	18068
50	17576	15802	19410	16872	19870	17232	20786	17944	21398	17937	22009	17950	23308	17842	24378	17556
55	17064	15341	18844	16380	19291	16730	20180	17421	20774	17414	21368	17427	22629	17322	23668	17045
60	16637	14958	18372	15971	18808	16312	19675	16985	20254	16978	20833	16991	22063	16888	23075	16618
65	16124	14497	17807	15479	18229	15809	19069	16462	19630	16456	20192	16468	21383	16368	22365	16107
70	15697	14113	17335	15069	17746	15391	18564	16026	19111	16020	19657	16032	20817	15935	21773	15680
75	15185	13653	16769	14577	17167	14888	17958	15503	18487	15497	19016	15509	20138	15415	21062	15168
80	14758	13269	16298	14167	16684	14470	17453	15067	17967	15061	18481	15073	19572	14982	20470	14742
82	14502	13038	16015	13921	16395	14219	17150	14805	17655	14800	18160	14811	19232	14721	20115	14486
85	14246	12808	15732	13676	16105	13968	16847	14544	17343	14539	17839	14549	18892	14461	19759	14230
87	14075	12655	15544	13512	15912	13800	16645	14370	17136	14364	17626	14375	18666	14288	19523	14060
90	13819	12424	15261	13266	15622	13549	16343	14108	16824	14103	17305	14113	18326	14028	19167	13804
95	13307	11964	14695	12774	15043	13047	15737	13585	16200	13580	16663	13590	17647	13508	18457	13292
100	12794	11503	14129	12282	14464	12544	15131	13062	15576	13057	16022	13067	16967	12988	17746	12780
105	12367	11119	13658	11872	13982	12126	14626	12626	15057	12621	15487	12631	16401	12555	17154	12354
110	11855	10659	13092	11381	13402	11623	14020	12103	14433	12099	14846	12108	15722	12035	16443	11842
115	11428	10275	12621	10971	12920	11205	13515	11667	13913	11663	14311	11672	15156	11601	15851	11416

Sensible capacity table

Trend of Total & Sensible Heat Capacity / Indoor Air & Outdoor Air Temperature.

Product models: **RAS-22EKV-UL / RAS-22EAV2-UL**

Standard condition

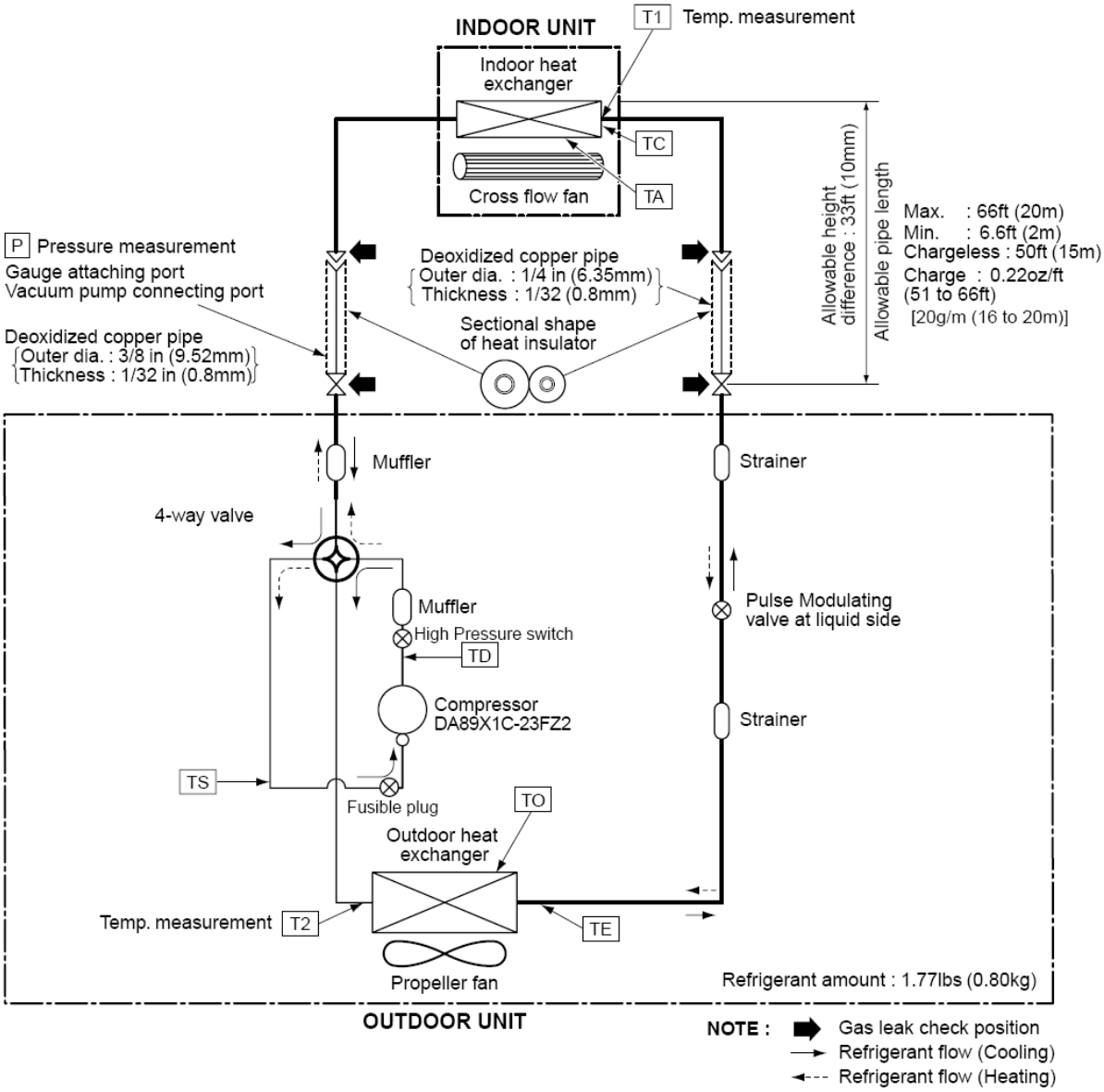
Indoor	80.0°F DB / 67.0°F WB
Outdoor	95.0°F DB / 75.0°F WB

Specification of product at standard condition.

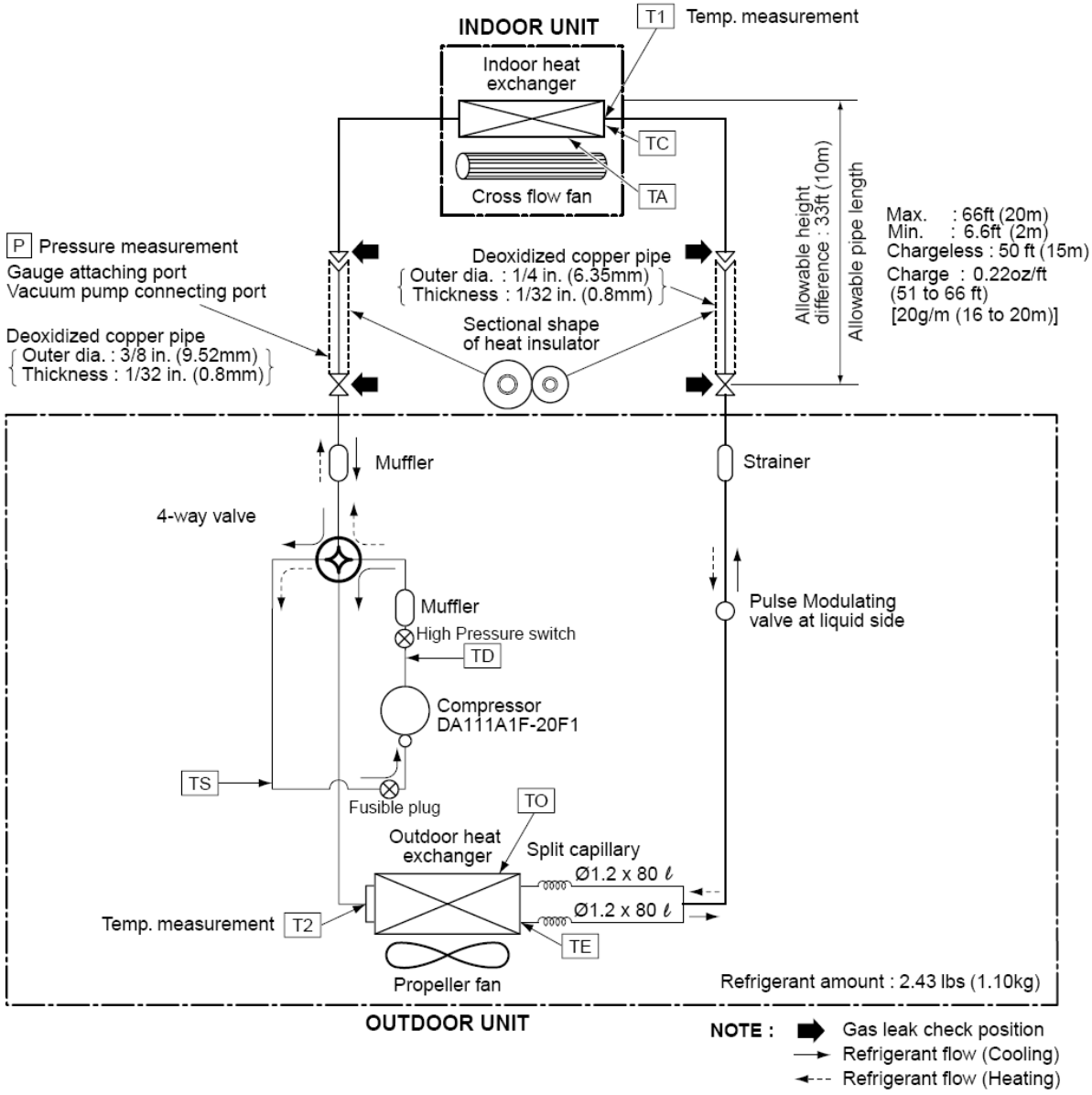
Total Cooling Capacity (TC)	21400 Btu/h
Sensible Heat Capacity (SHC)	15800 Btu/h
Air flow volume	636 CFM

	Indoor coil air temperature															
Outdoor	68.0°F DB		73.0°F DB		75.0°F DB		79.0°F DB		80.0°F DB		82.0°F DB		86.0°F DB		90.0°F DB	
coil air temp.	57.0°F WB		61.0°F WB		63.0°F WB		64.0°F WB		67.0°F WB		68.0°F WB		72.0°F WB		75.0°F WB	
°F DB	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC	TC	SHC
0	29534	23601	32615	25092	33388	25619	34927	26661	35956	26547	36984	26466	39166	26066	40964	25407
5	28857	23060	31868	24517	32623	25032	34127	26050	35132	25938	36136	25860	38269	25469	40026	24825
10	28180	22519	31121	23942	31858	24445	33327	25439	34308	25330	35289	25253	37371	24871	39087	24242
15	27616	22069	30498	23462	31221	23956	32660	24930	33621	24823	34583	24748	36624	24374	38305	23757
20	26940	21528	29750	22888	30456	23369	31859	24319	32797	24215	33735	24142	35726	23776	37366	23175
25	26376	21077	29128	22408	29818	22880	31192	23810	32111	23708	33029	23636	34978	23279	36584	22690
30	25699	20537	28380	21833	29053	22293	30392	23199	31287	23100	32182	23030	34081	22681	35645	22108
35	25135	20086	27757	21354	28415	21804	29725	22690	30600	22593	31475	22524	33333	22184	34863	21623
40	24458	19545	27010	20779	27650	21217	28925	22079	29776	21984	30628	21918	32435	21586	33924	21040
45	23894	19094	26387	20300	27013	20727	28258	21570	29090	21477	29922	21412	31687	21089	33142	20555
50	23218	18554	25640	19725	26248	20140	27457	20959	28266	20869	29074	20806	30790	20491	32203	19973
55	22541	18013	24893	19150	25483	19553	26657	20348	27442	20261	28227	20200	29892	19894	31265	19391
60	21977	17562	24270	18671	24845	19064	25990	19839	26755	19754	27521	19694	29145	19396	30482	18906
65	21300	17021	23522	18096	24080	18477	25190	19228	25931	19146	26673	19088	28247	18799	29544	18324
70	20736	16571	22900	17617	23442	17988	24523	18719	25245	18639	25967	18582	27499	18301	28761	17838
75	20059	16030	22152	17042	22677	17401	23723	18108	24421	18030	25119	17976	26602	17704	27823	17256
80	19495	15579	21529	16563	22040	16911	23056	17599	23734	17524	24413	17471	25854	17206	27041	16771
82	19157	15309	21156	16276	21657	16618	22655	17293	23322	17219	23989	17167	25405	16908	26571	16480
85	18819	15038	20782	15988	21275	16324	22255	16988	22910	16915	23566	16864	24956	16609	26102	16189
87	18593	14858	20533	15796	21020	16129	21988	16784	22636	16712	23283	16662	24657	16410	25789	15995
90	18255	14588	20159	15509	20637	15835	21588	16479	22224	16408	22860	16359	24208	16111	25320	15704
95	17578	14047	19412	14934	19872	15248	20788	15868	21400	15800	22012	15752	23311	15514	24381	15122
100	16881	13490	18643	14342	19085	14644	19964	15239	20552	15174	21140	15128	22387	14899	23415	14522
105	14150	11308	15627	12022	15997	12275	16734	12774	17227	12719	17720	12681	18765	12489	19627	12173
110	12807	10235	14144	10881	14479	11110	15146	11561	15592	11512	16038	11477	16984	11303	17764	11018
115	8665	6924	9569	7362	9796	7516	10247	7822	10549	7789	10851	7765	11491	7647	12018	7454

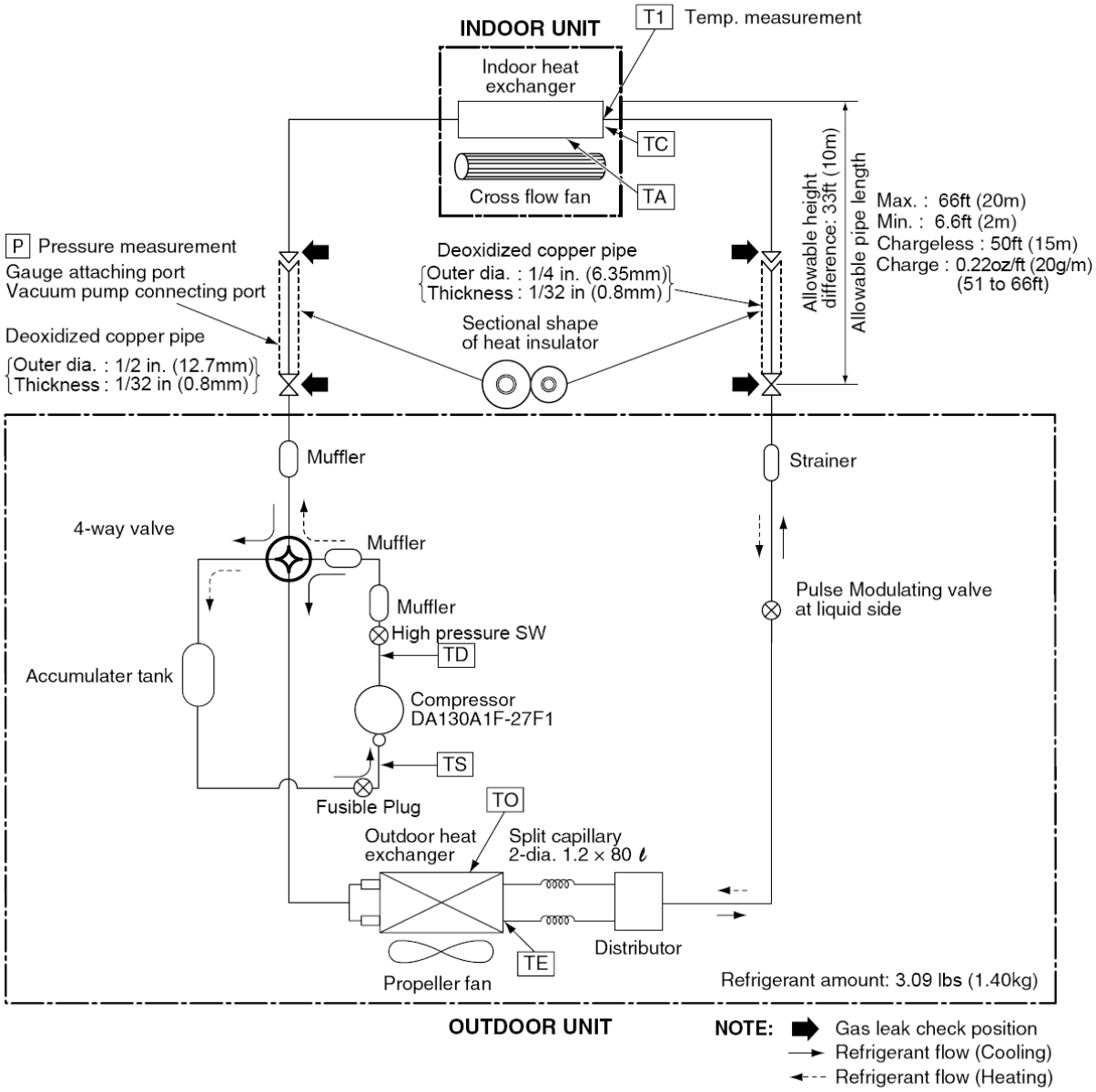
Refrigerant cycle diagram: RAS-09EKV-UL / RAS-09EAV2-UL



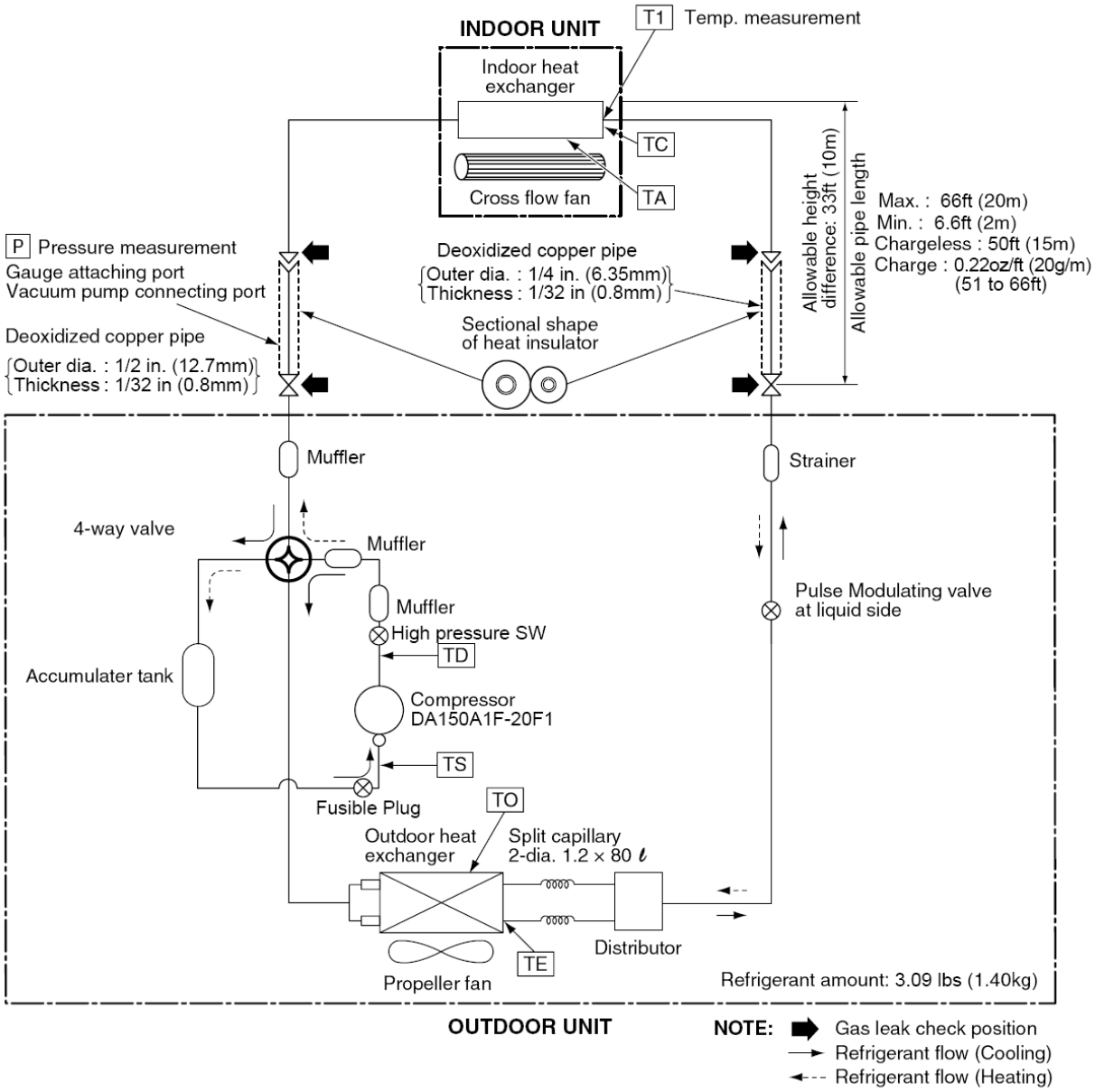
Refrigerant cycle diagram: RAS-12EKV-UL / RAS-12EAV2-UL



Refrigerant cycle diagram: RAS-15EKV-UL / RAS-15EAV2-UL
RAS-17EKV-UL / RAS-17EAV2-UL

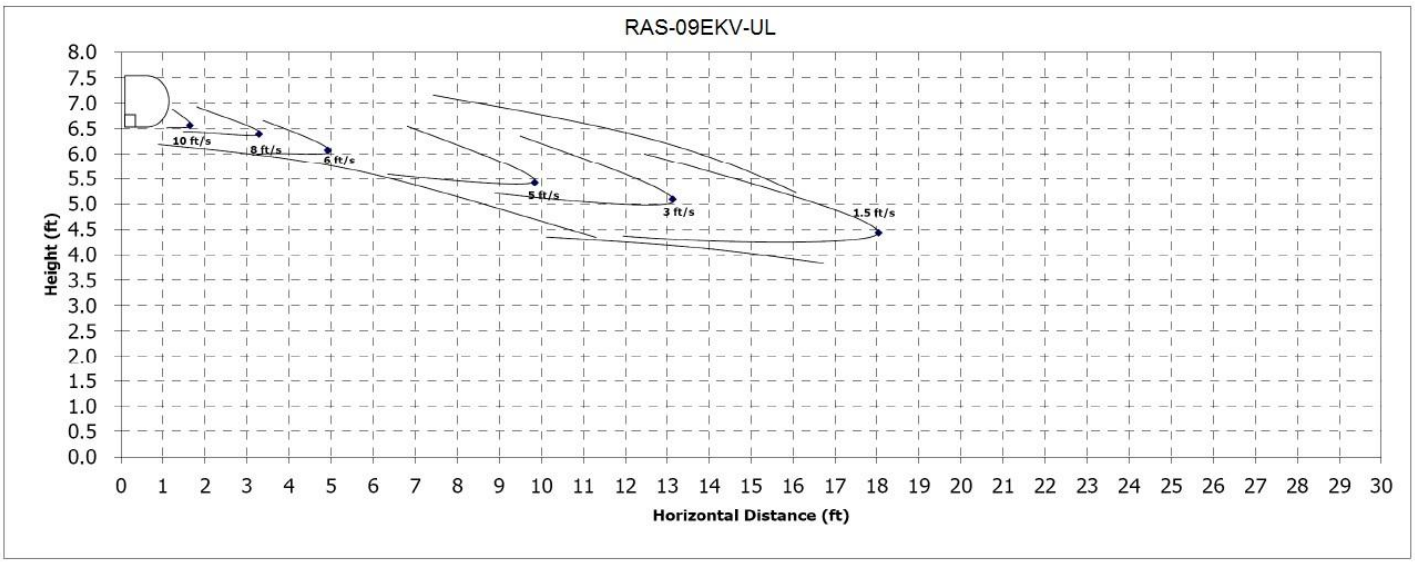


Refrigerant cycle diagram: RAS-22EKV-UL / RAS-22EAV2-UL

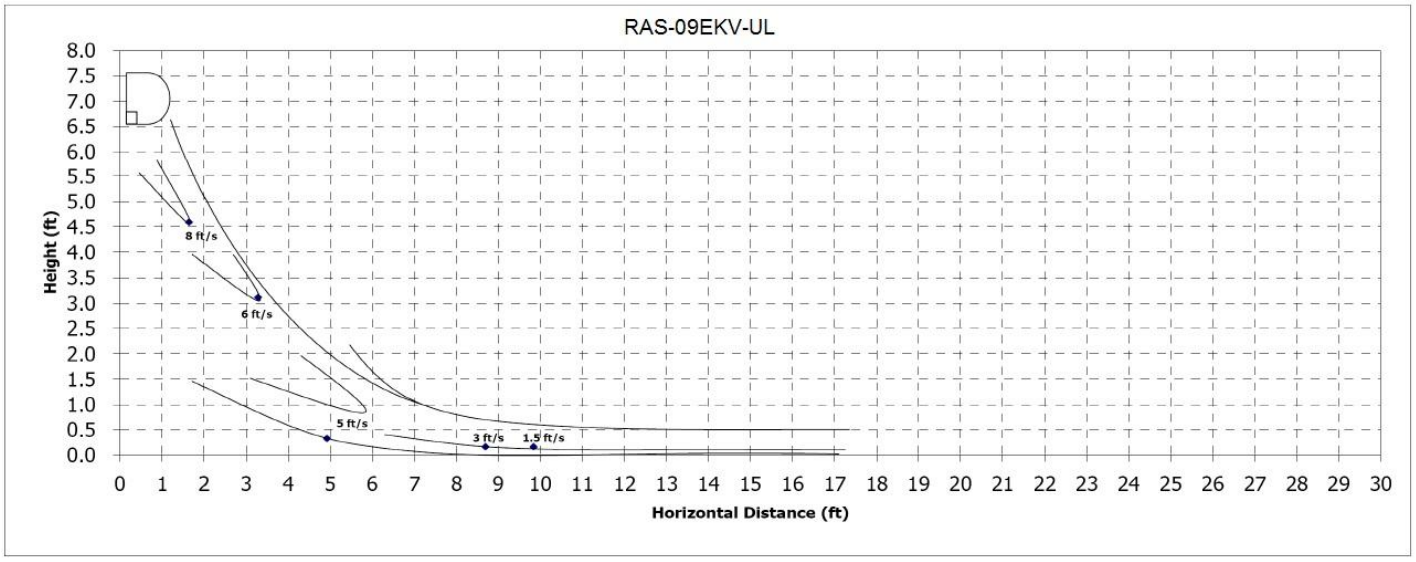


Air throw chart

Cooling

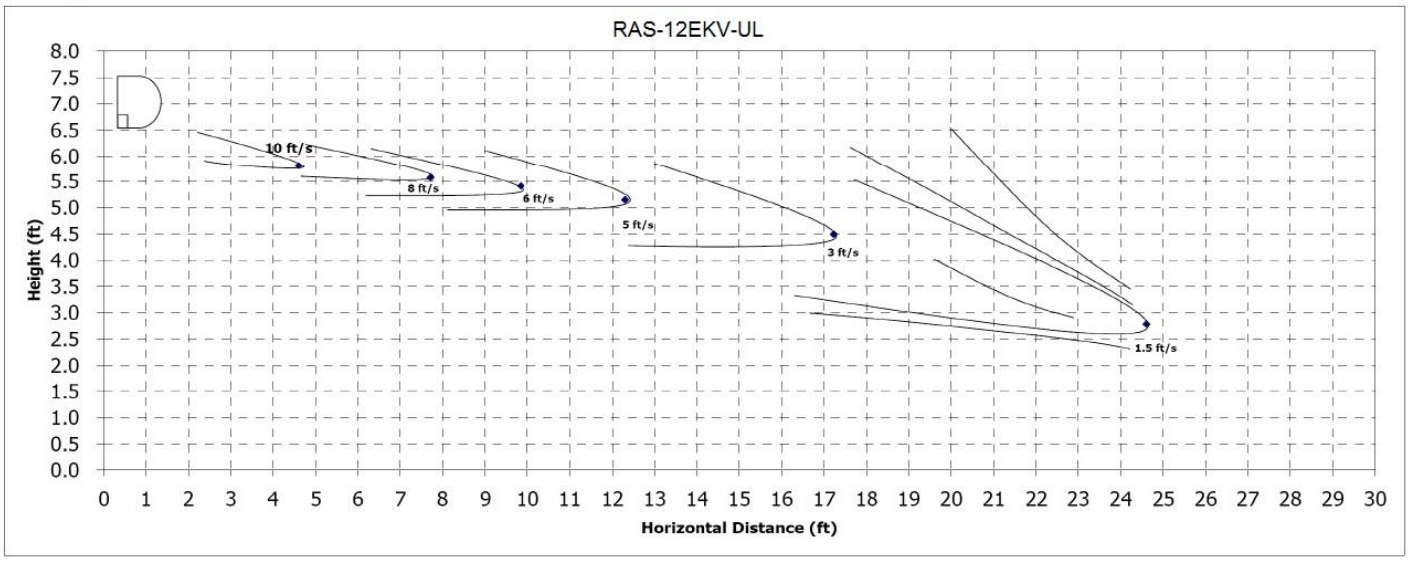


Heating

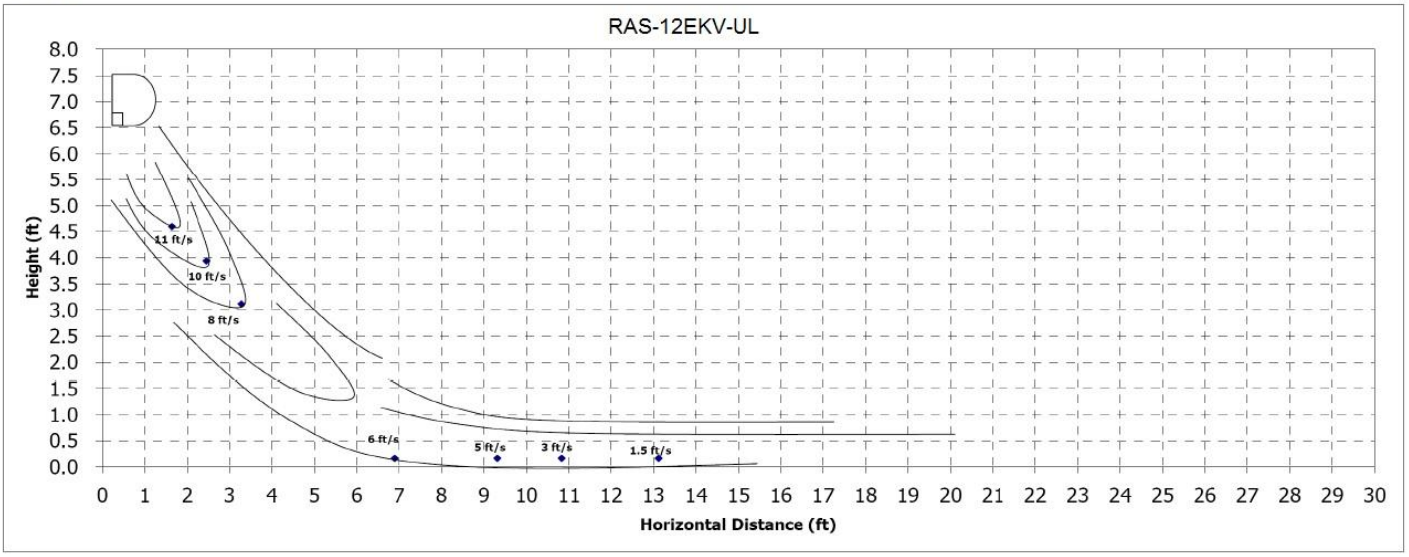


Air throw chart

Cooling

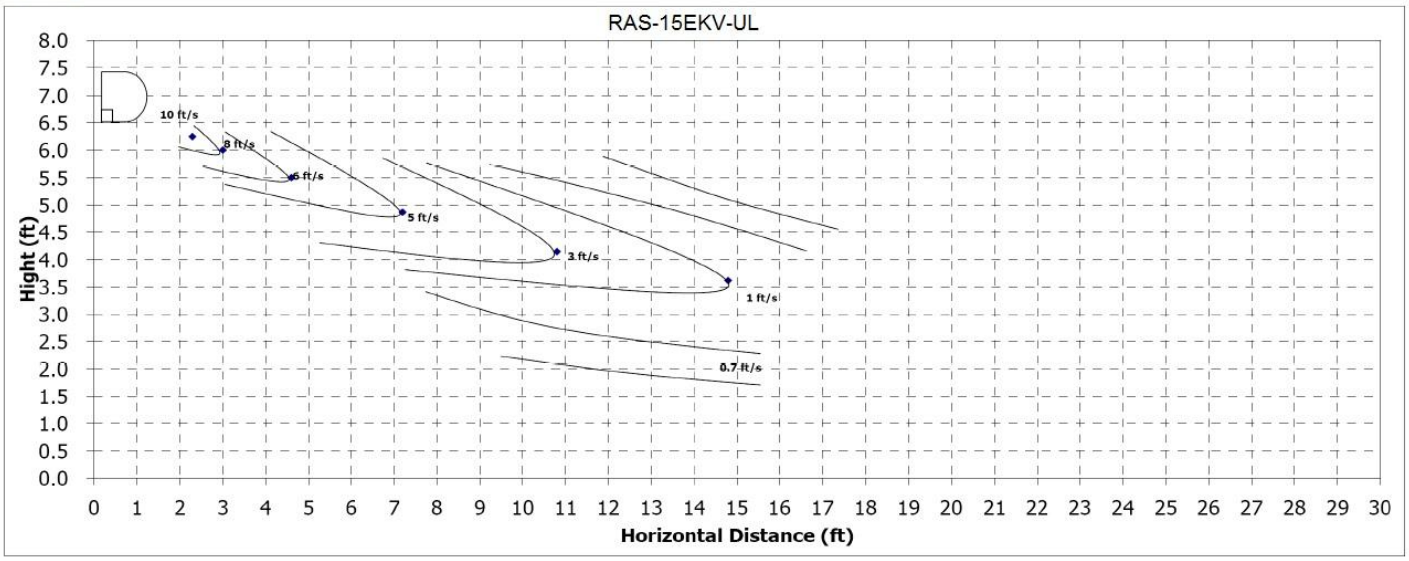


Heating

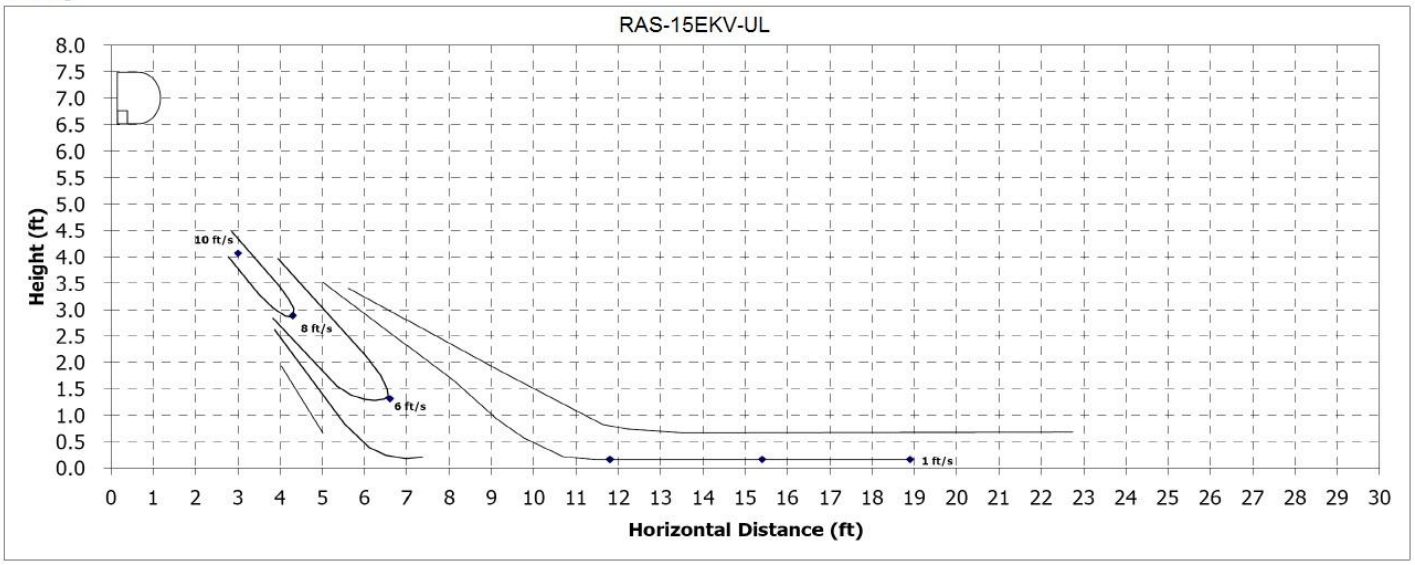


Air throw chart

Cooling

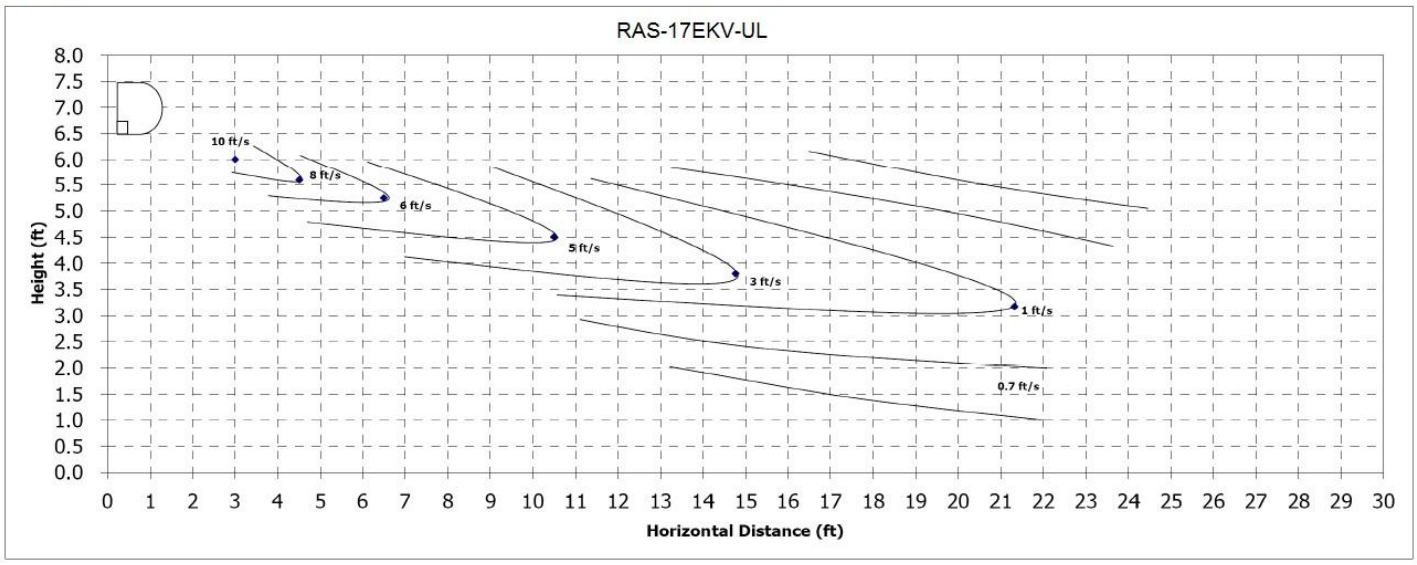


Heating

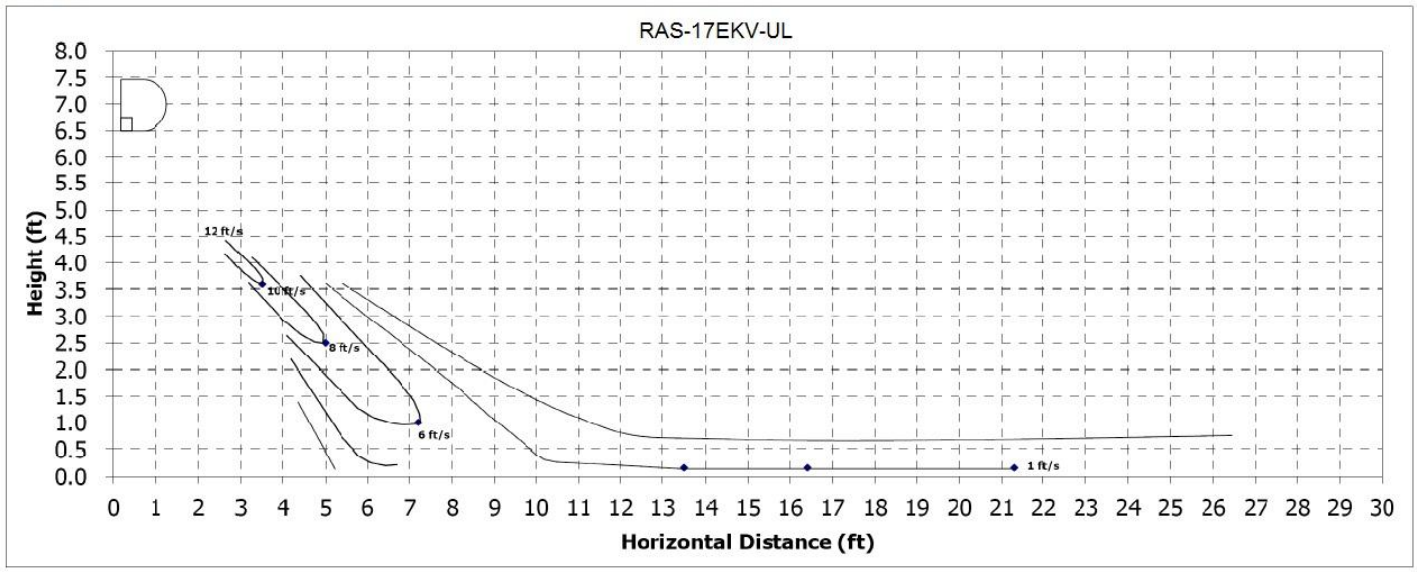


Air throw chart

Cooling

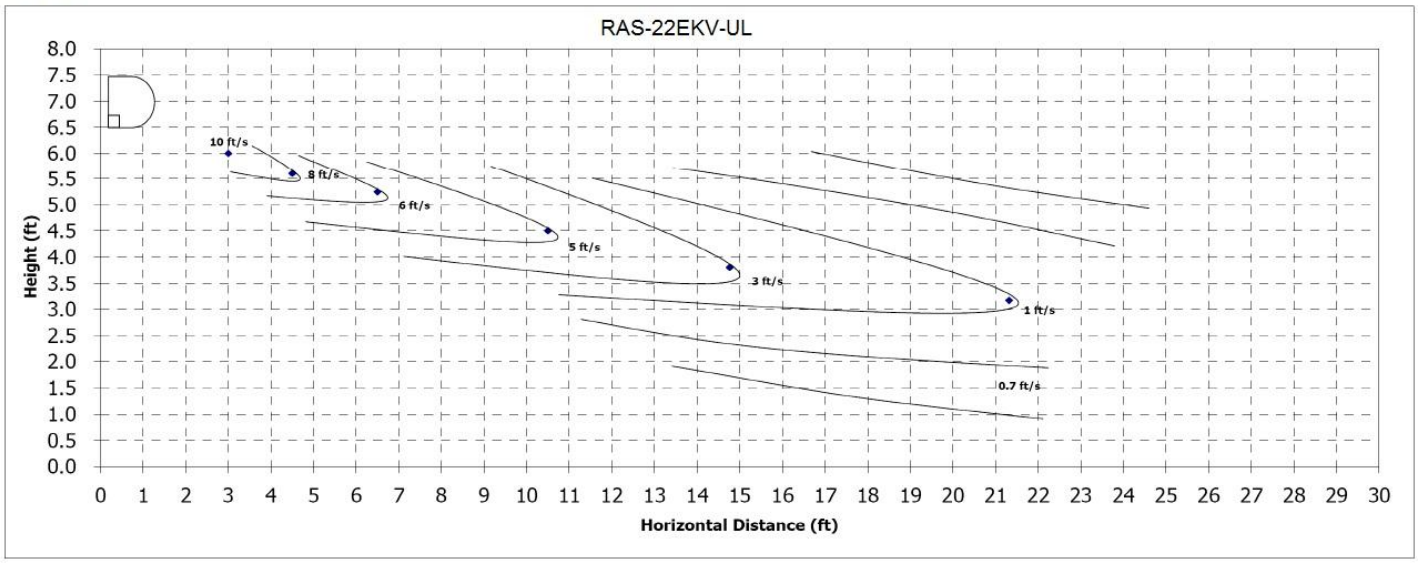


Heating

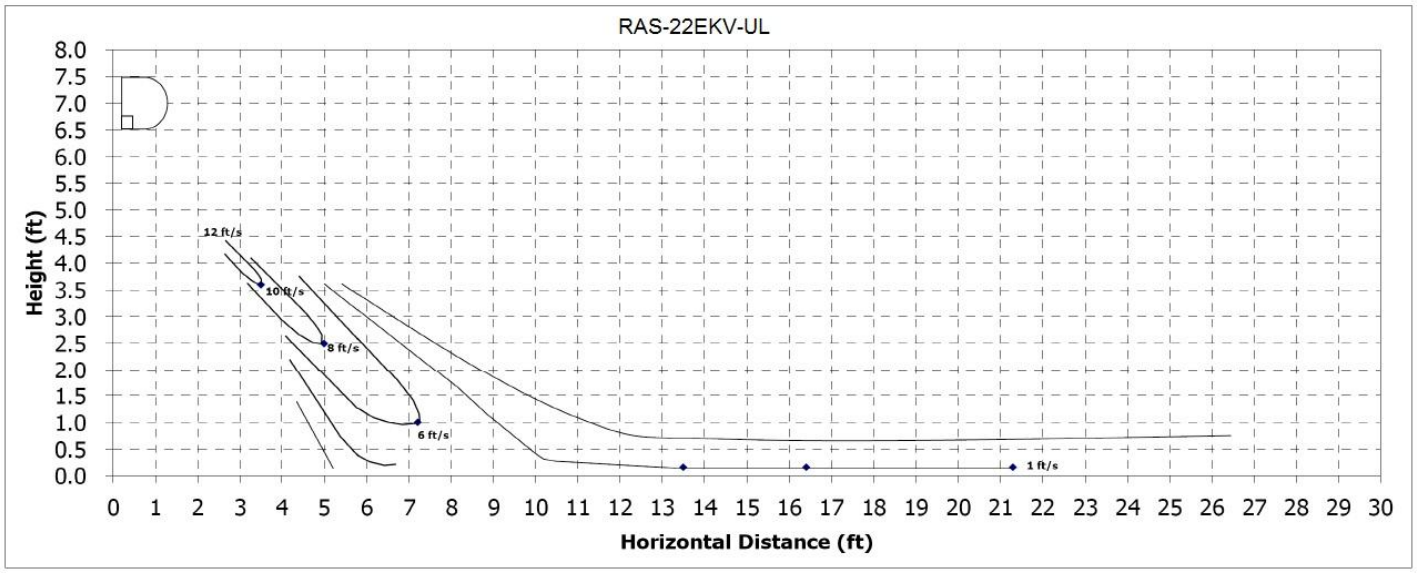


Air throw chart

Cooling



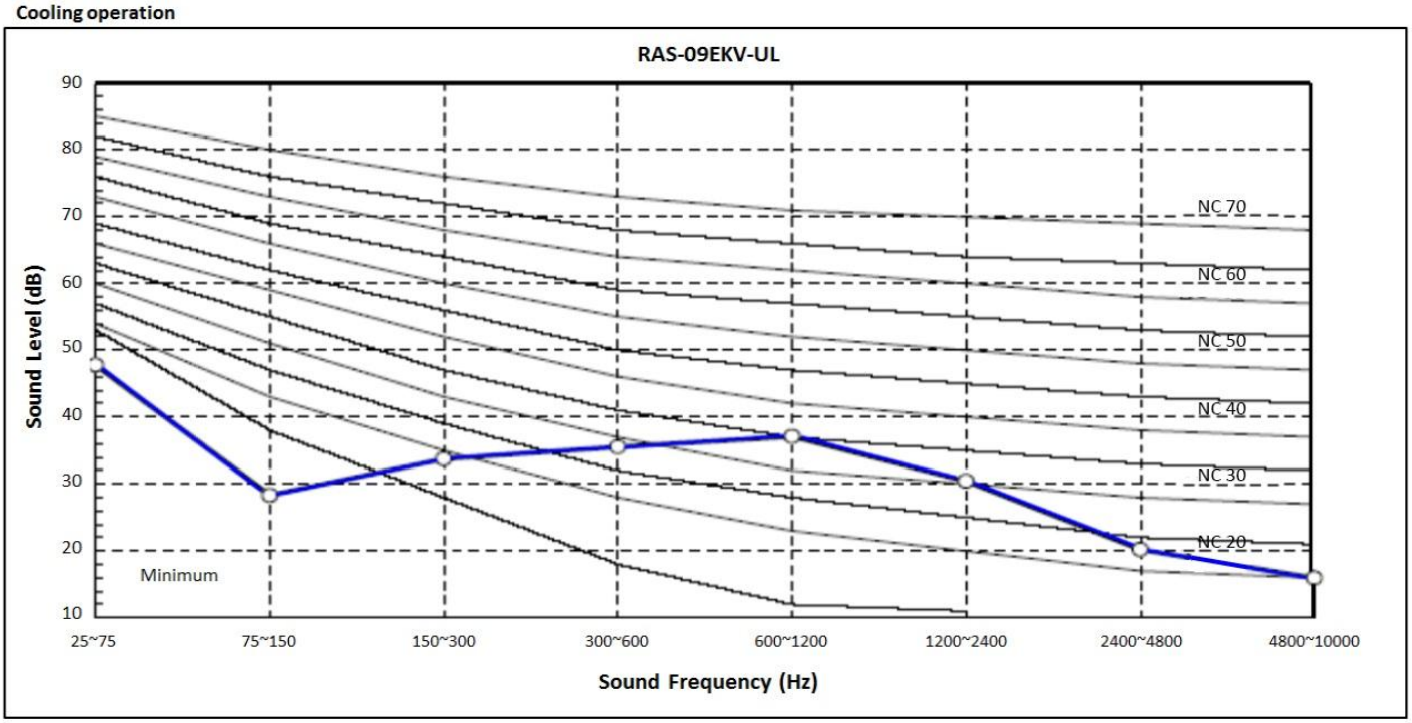
Heating



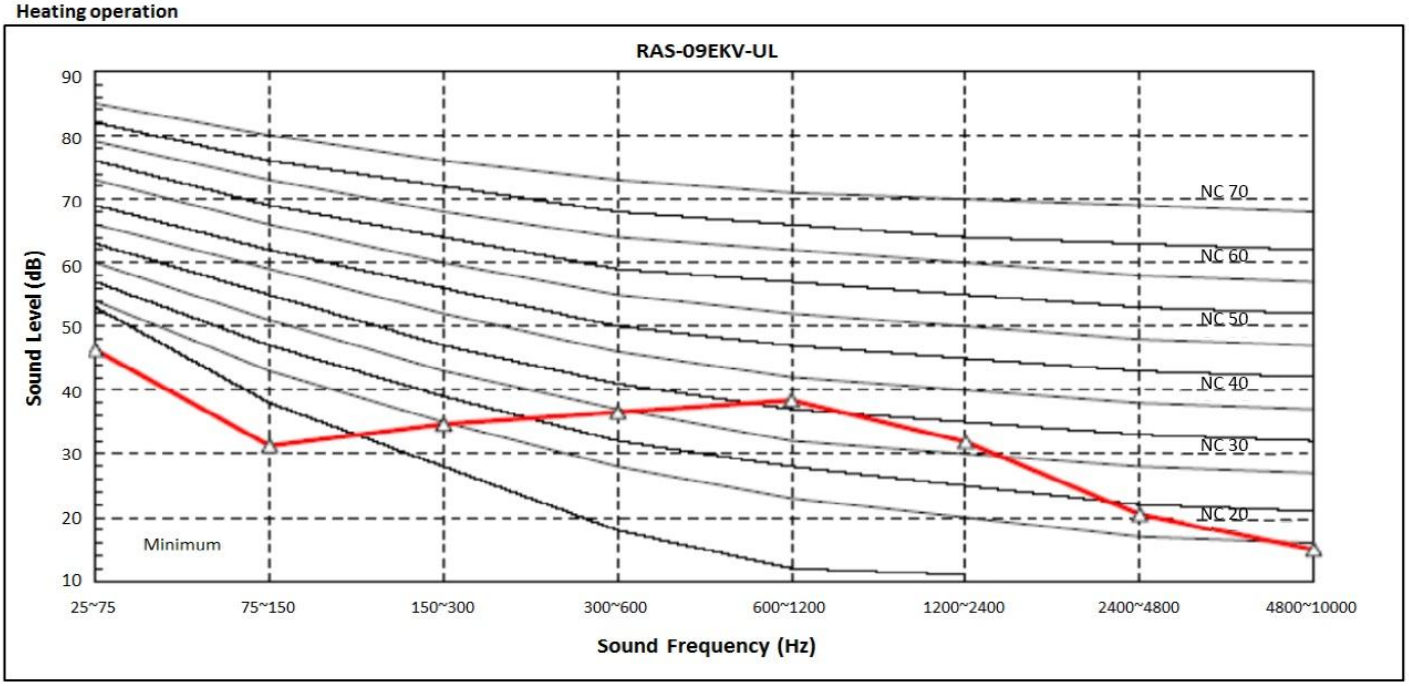
Indoor and outdoor sound characteristic

RAS-09EKV-UL

Cooling operation



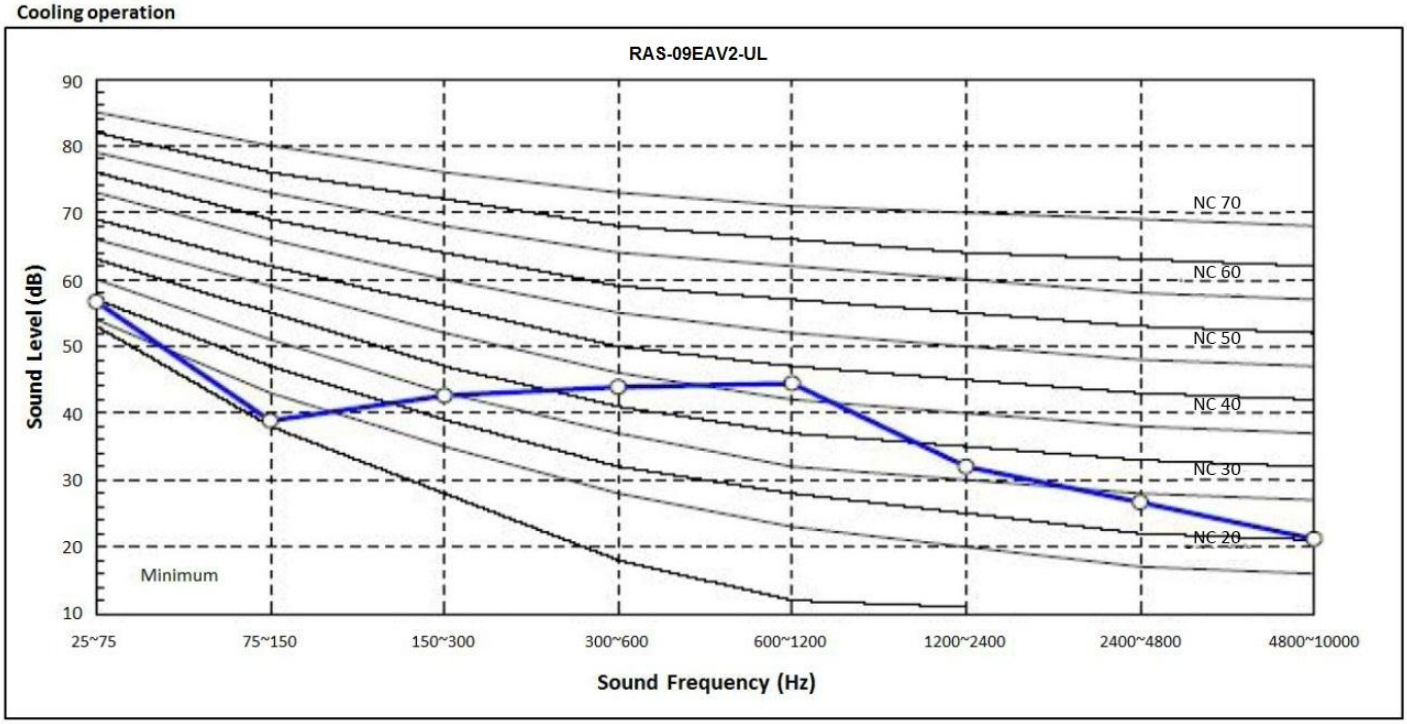
Heating operation



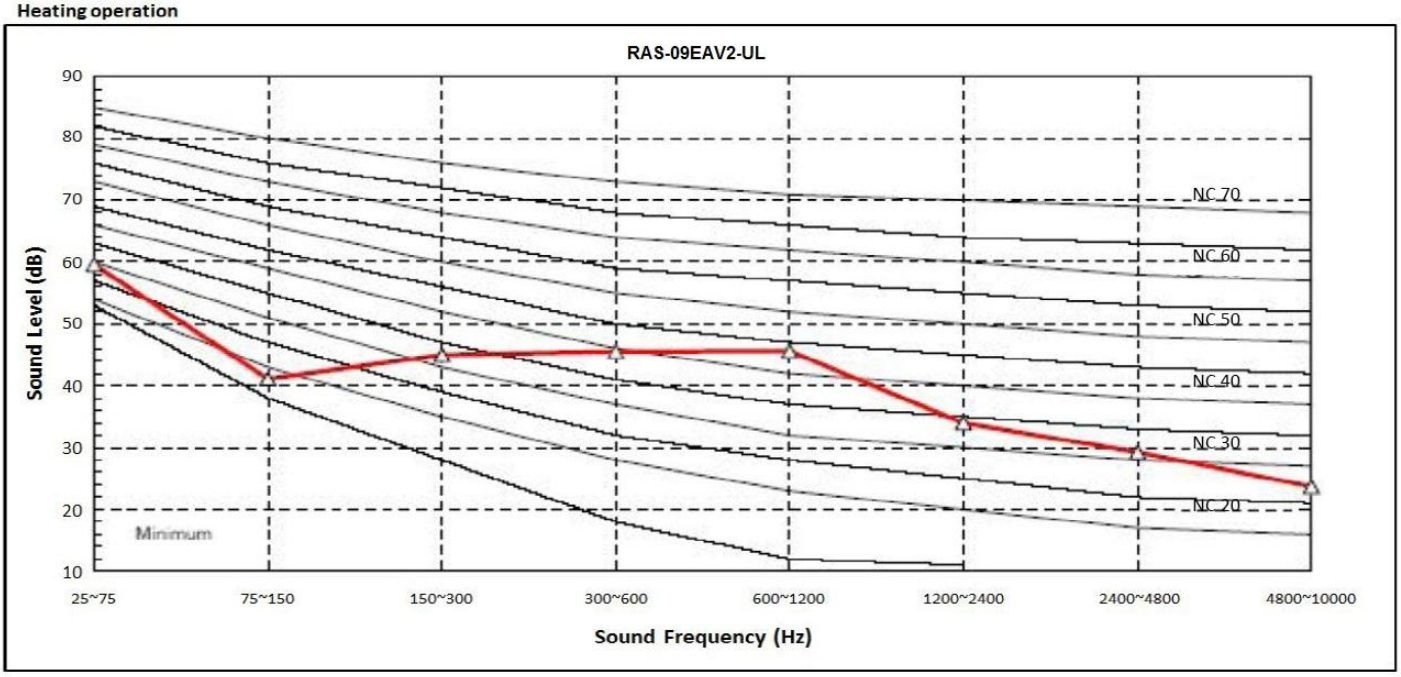
Indoor and outdoor sound characteristic

RAS-09EAV2-UL

Cooling operation



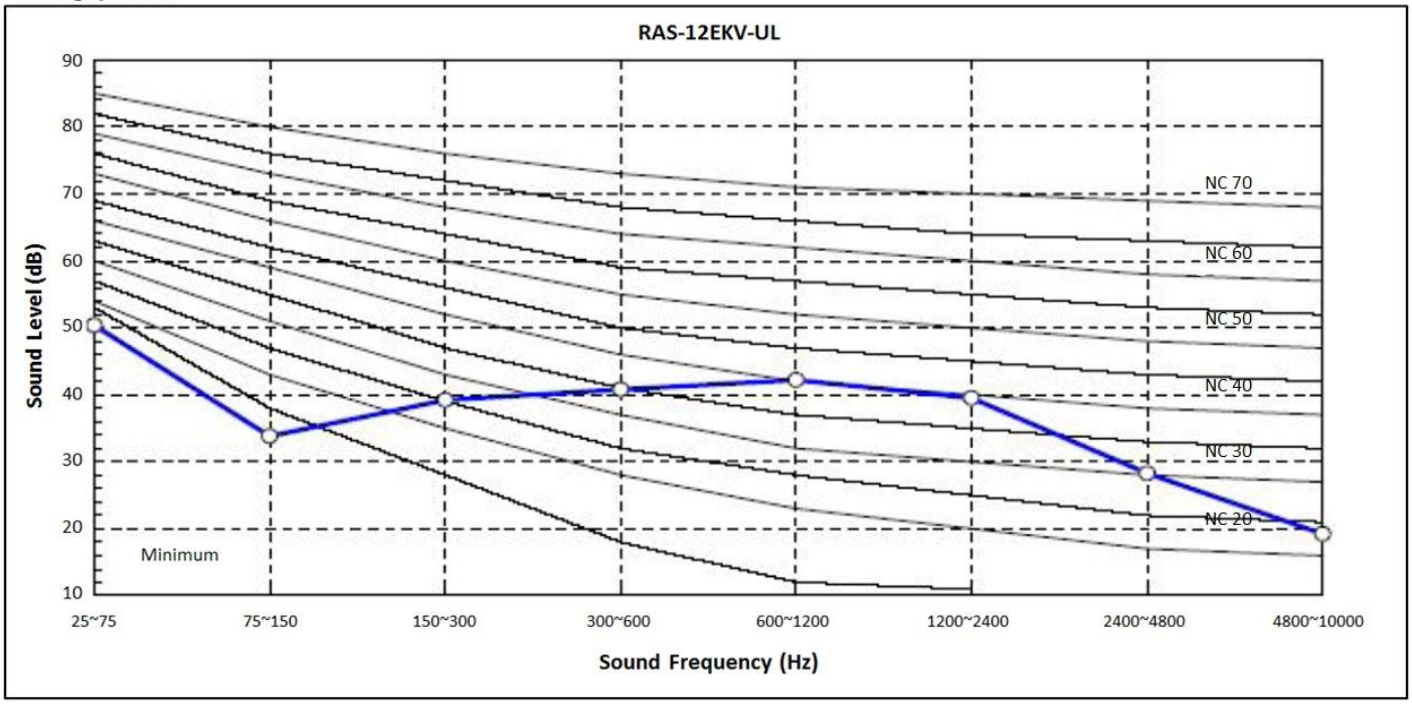
Heating operation



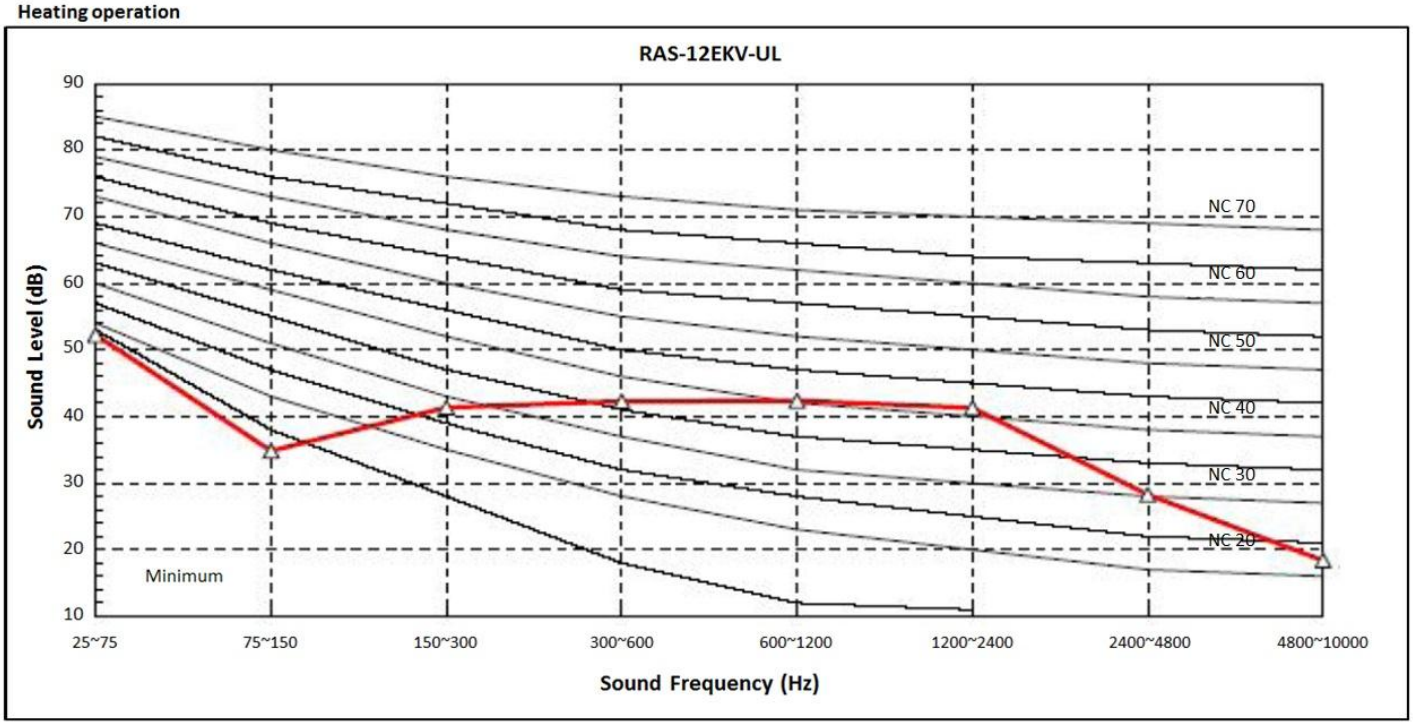
Indoor and outdoor sound characteristic

RAS-12EKV-UL

Cooling operation



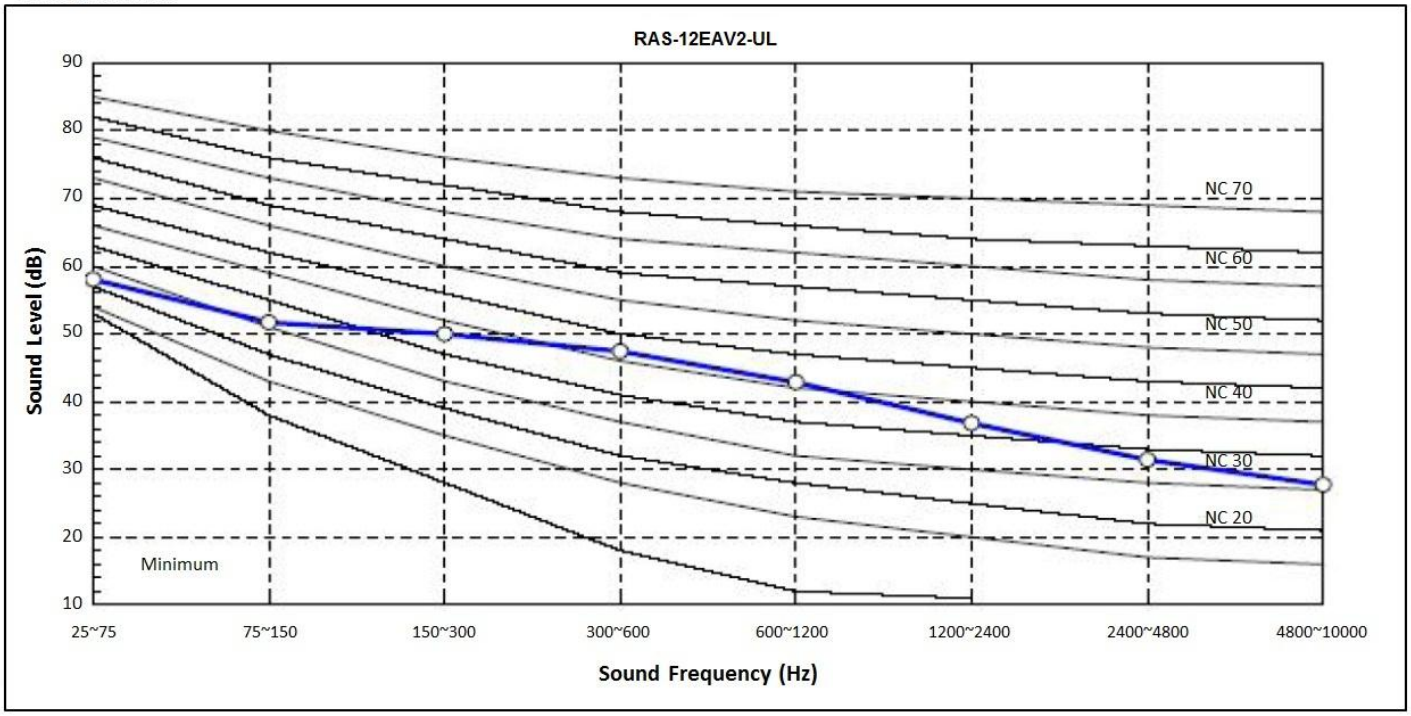
Heating operation



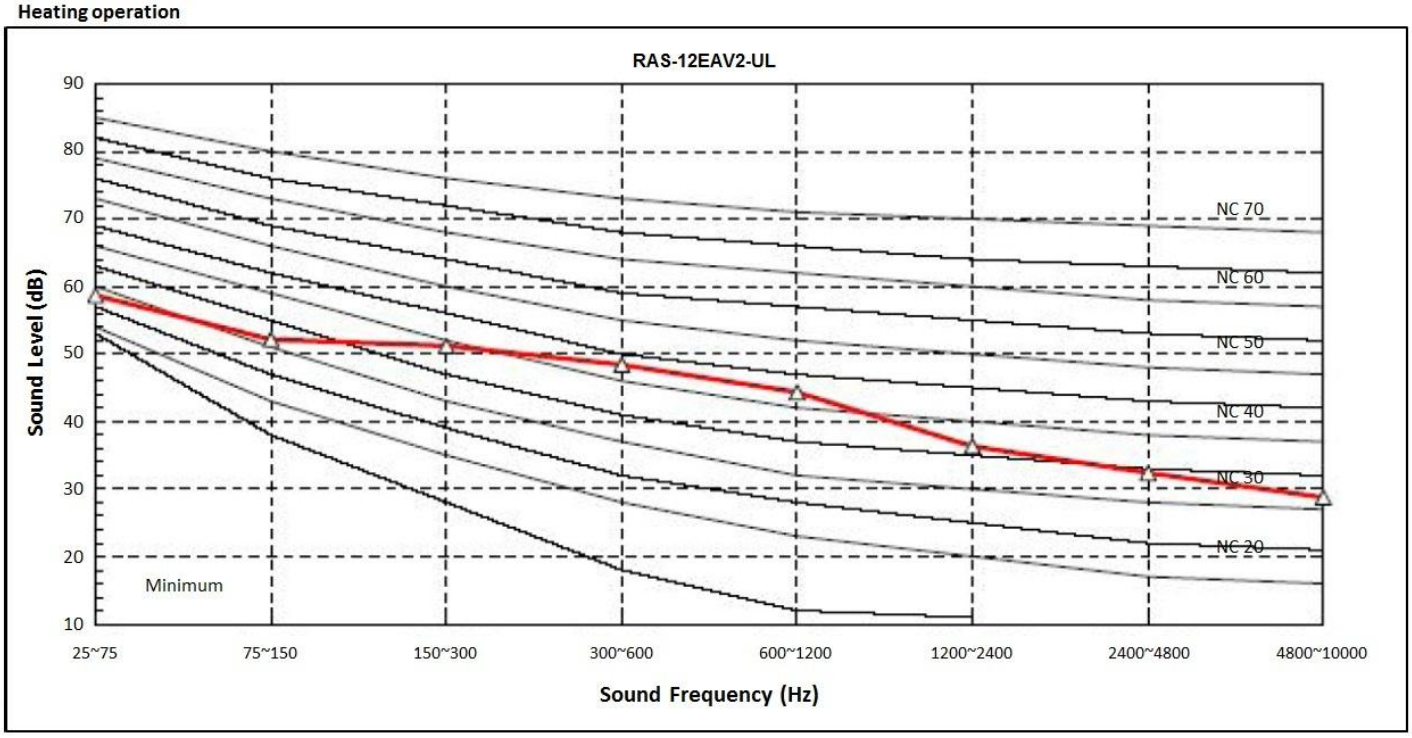
Indoor and outdoor sound characteristic

RAS-12EAV2-UL

Cooling operation



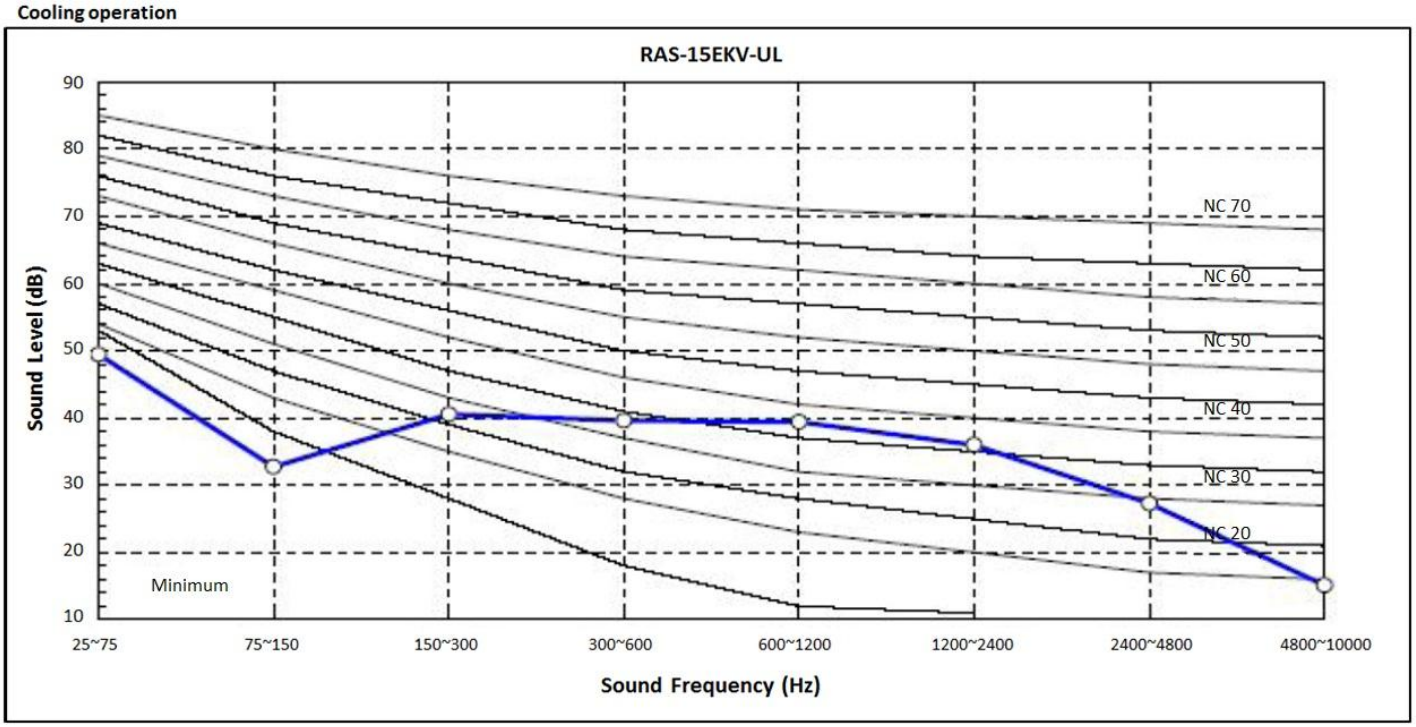
Heating operation



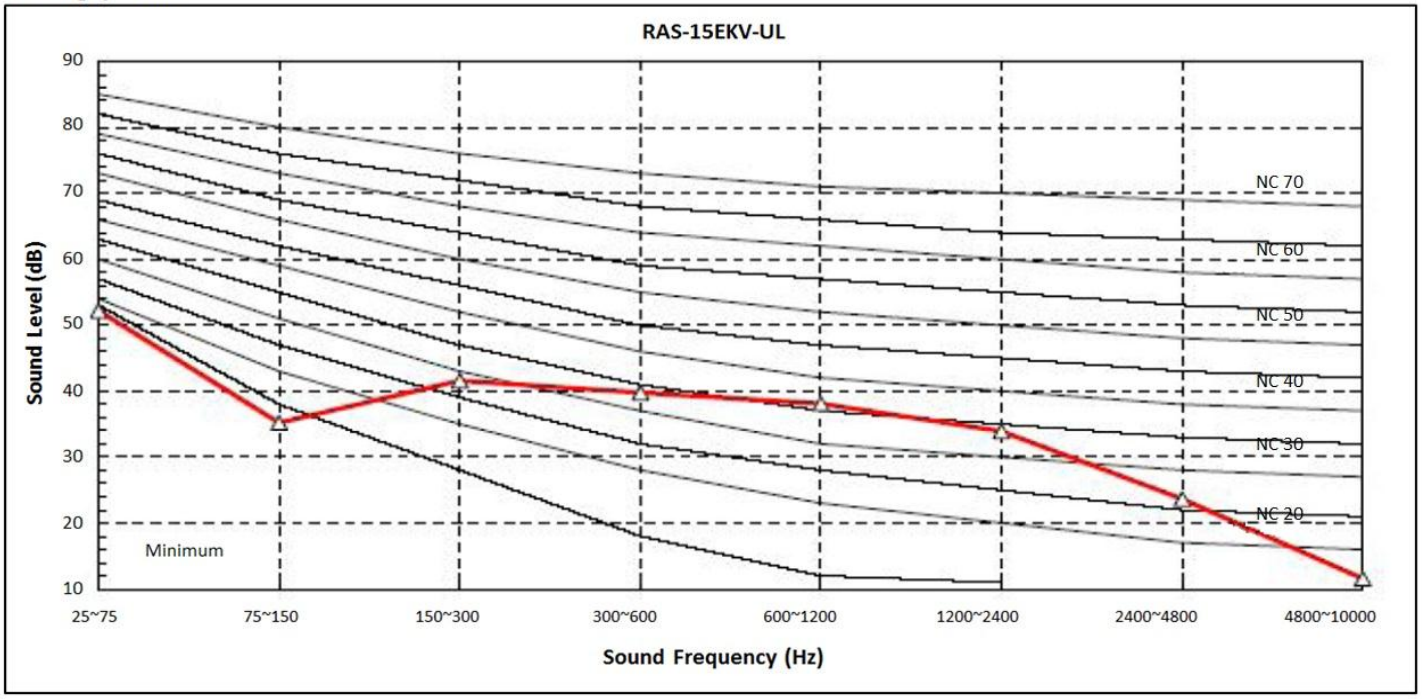
Indoor and outdoor sound characteristic

RAS-15EKV-UL

Cooling operation



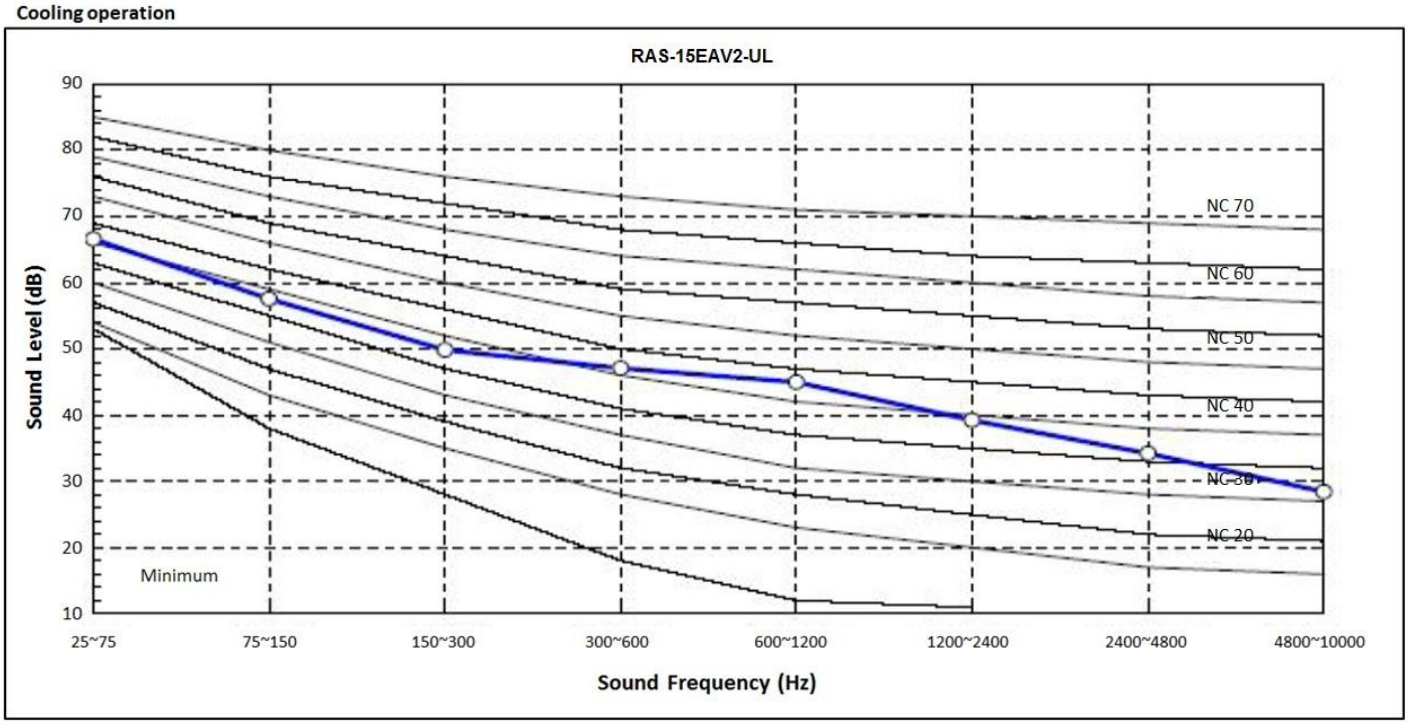
Heating operation



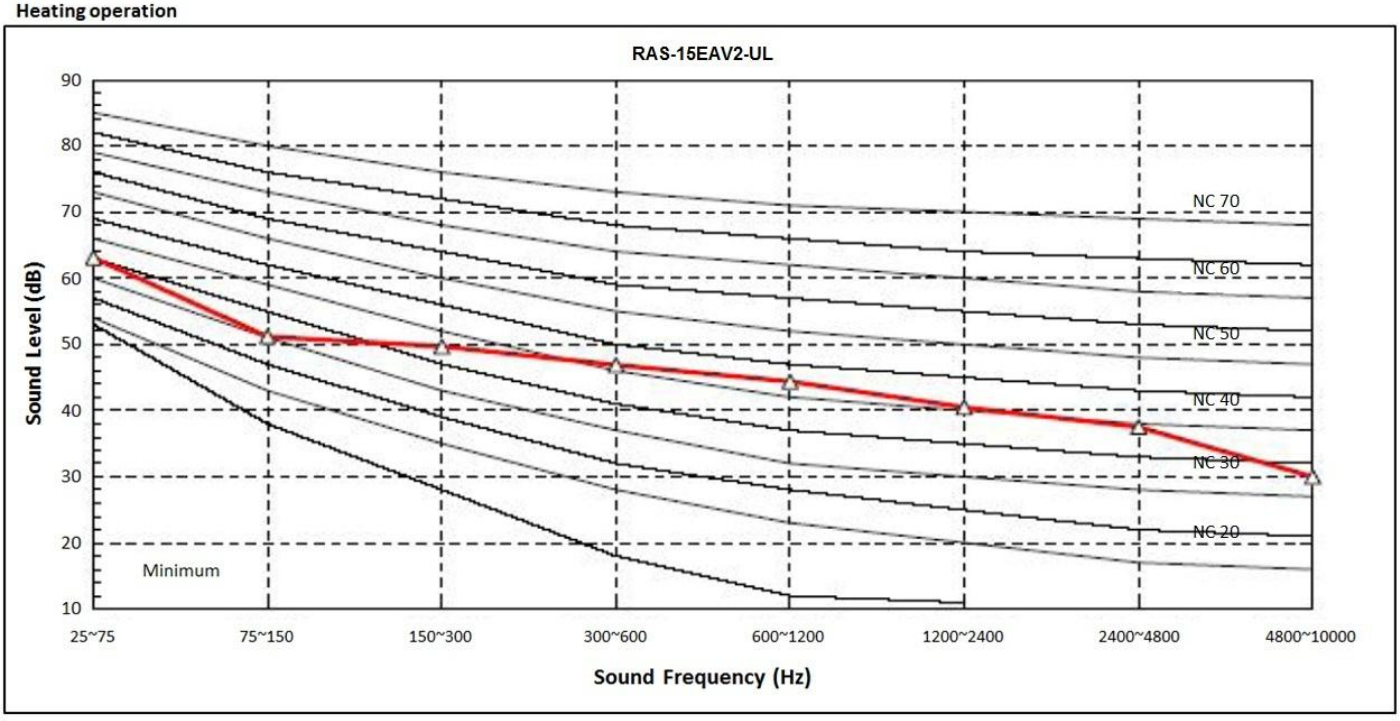
Indoor and outdoor sound characteristic

RAS-15EAV2-UL

Cooling operation



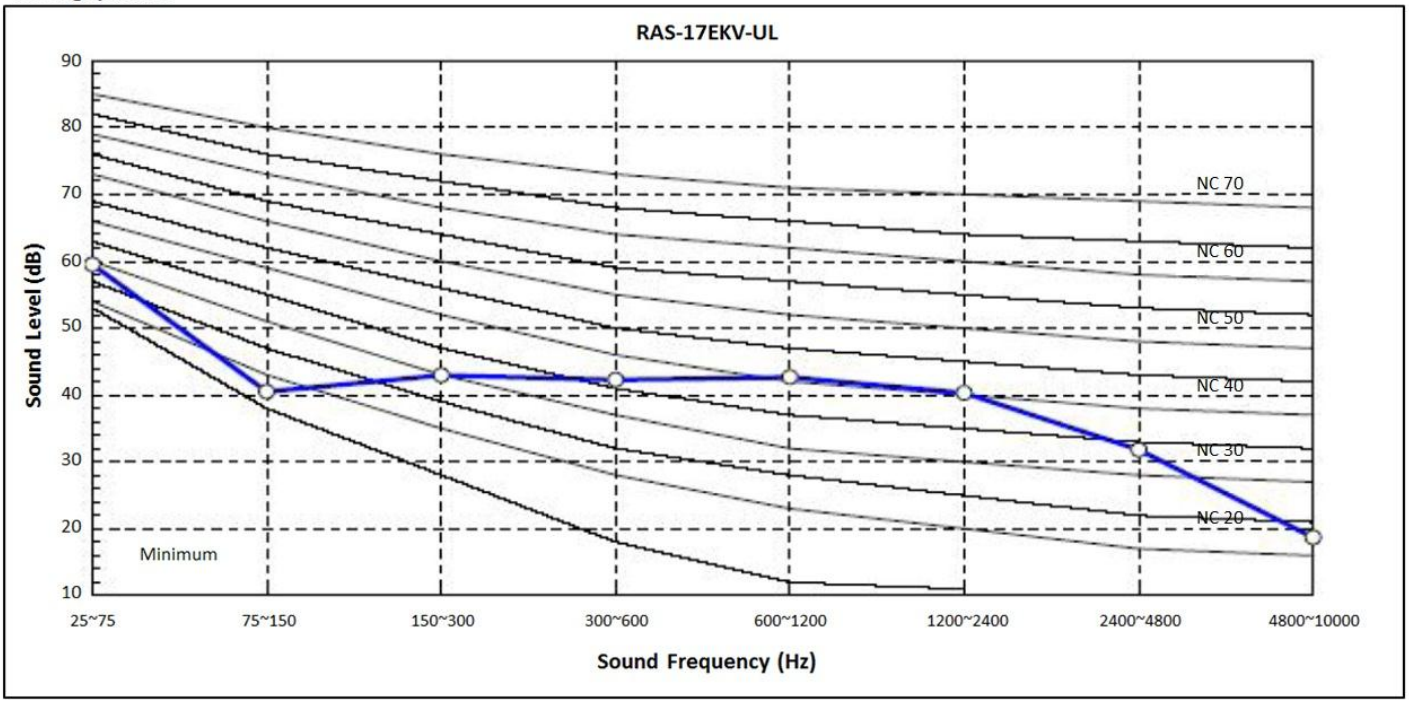
Heating operation



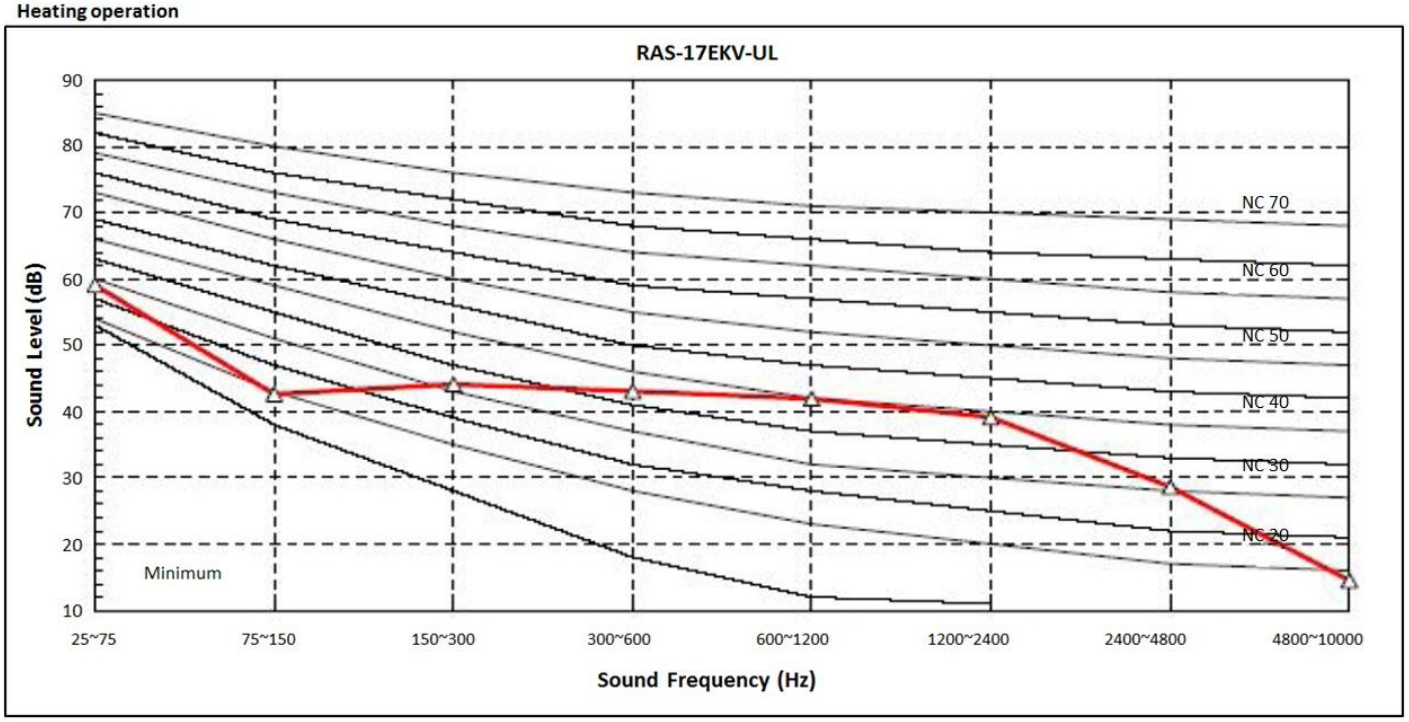
Indoor and outdoor sound characteristic

RAS-17EKV-UL

Cooling operation



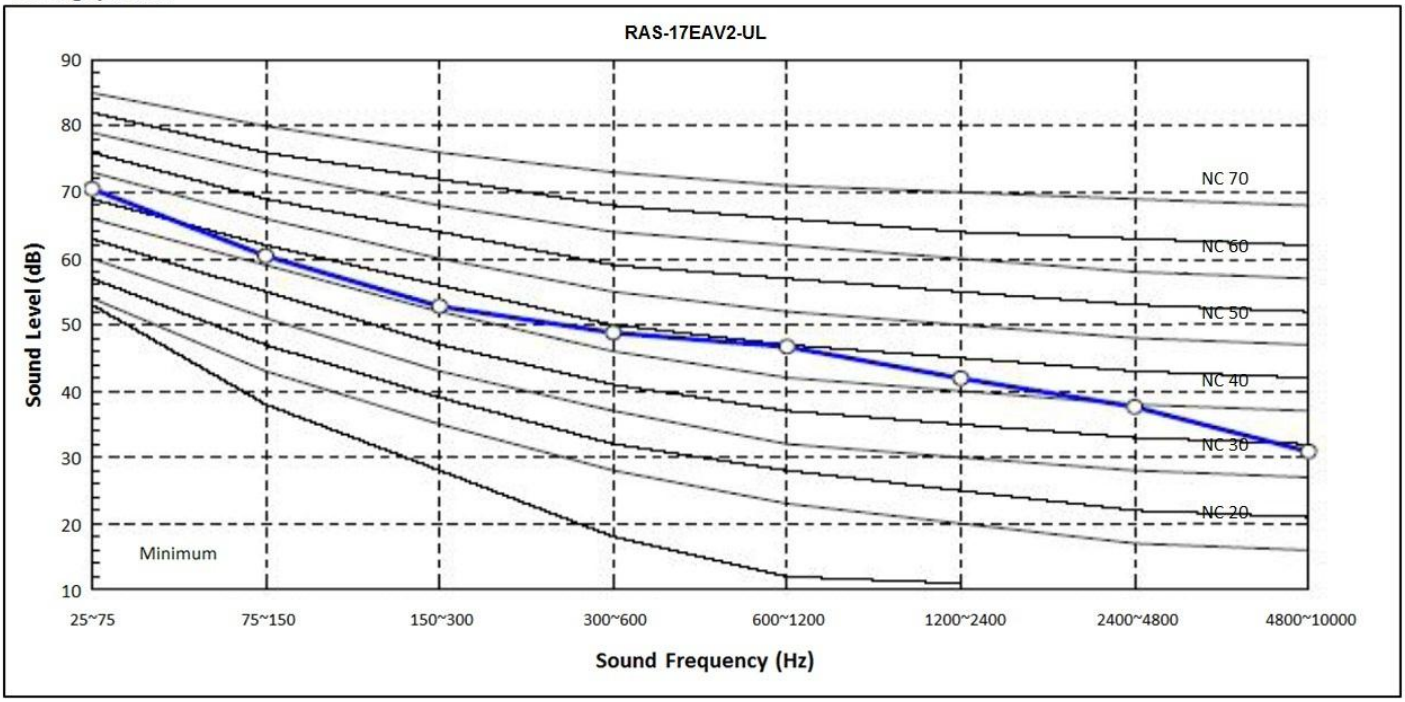
Heating operation



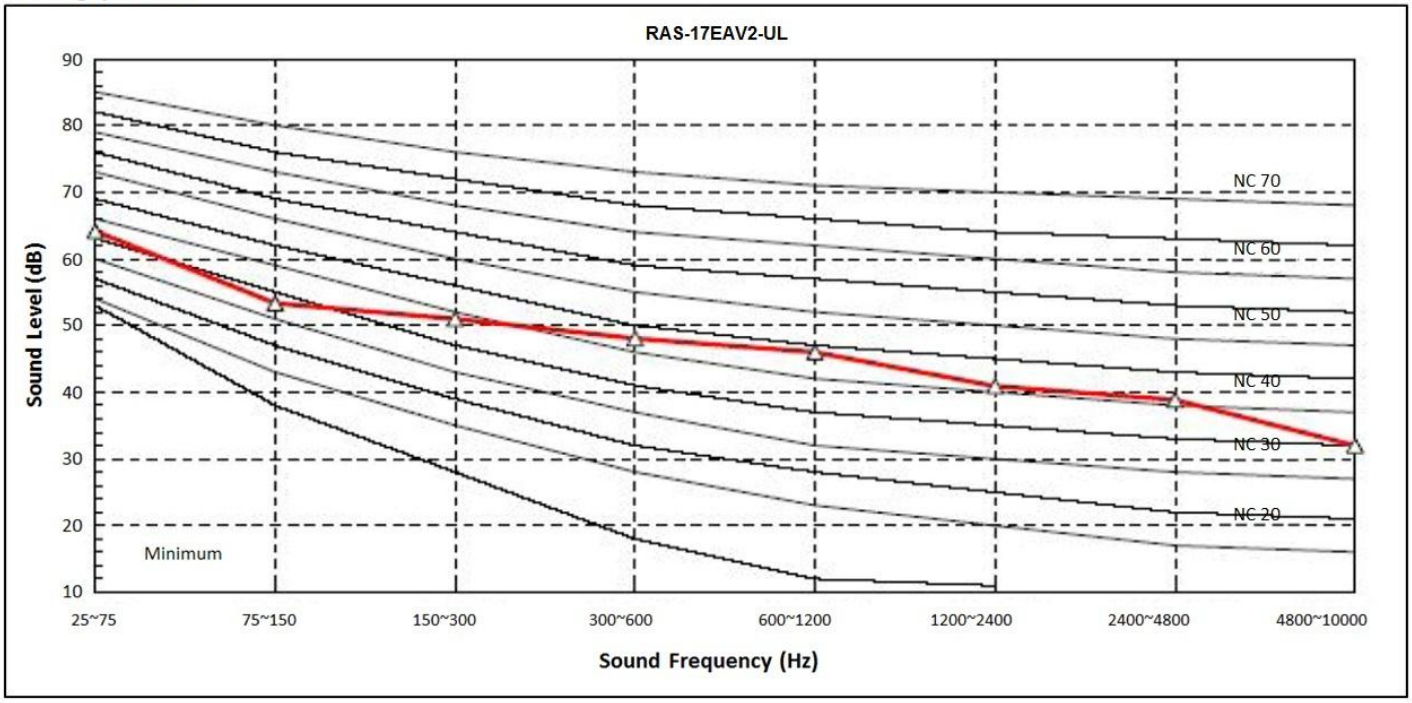
Indoor and outdoor sound characteristic

RAS-17EAV2-UL

Cooling operation



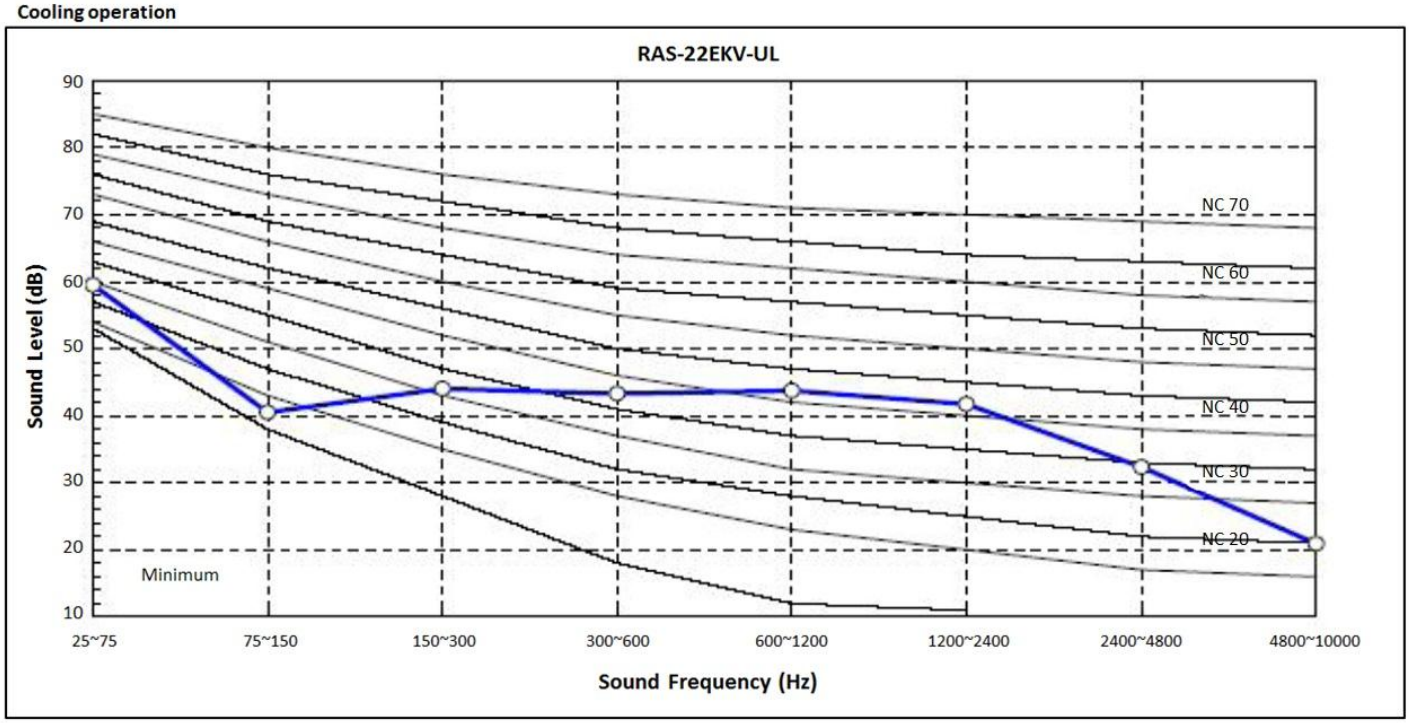
Heating operation



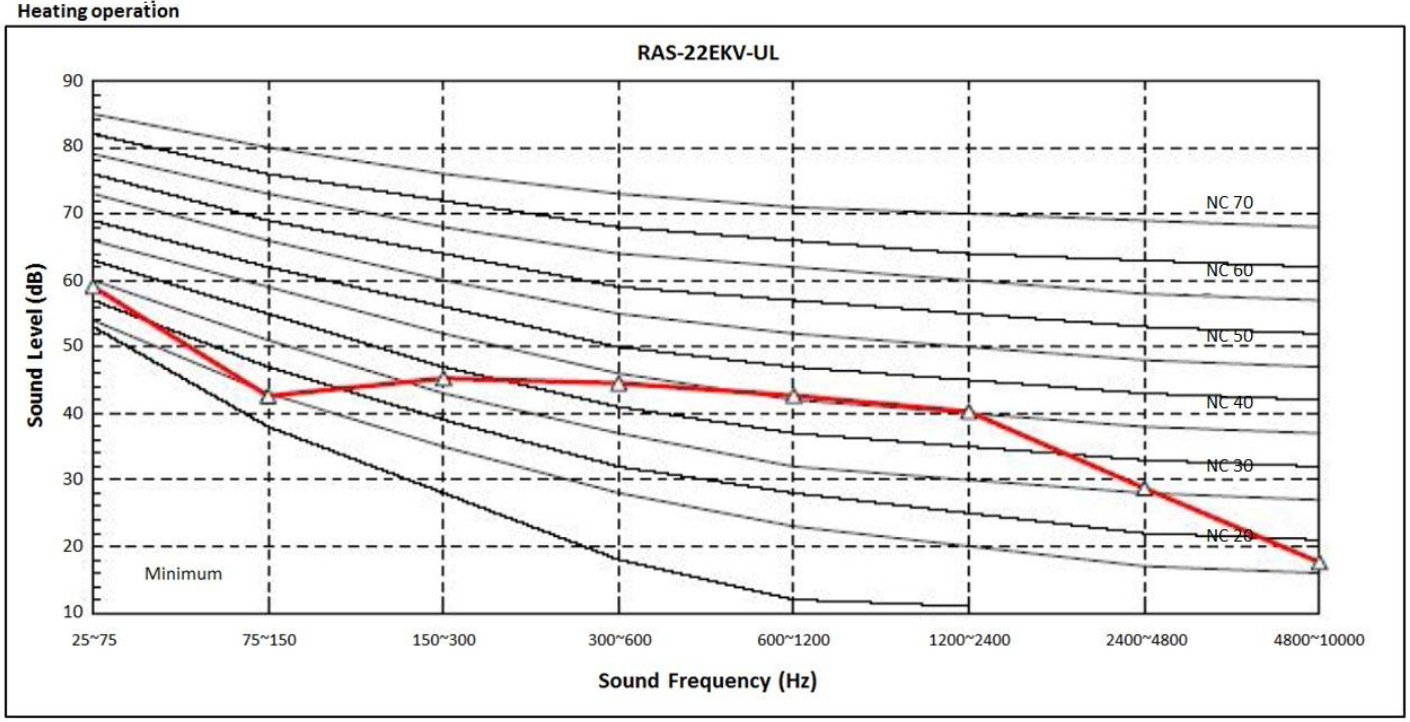
Indoor and outdoor sound characteristic

RAS-22EKV-UL

Cooling operation



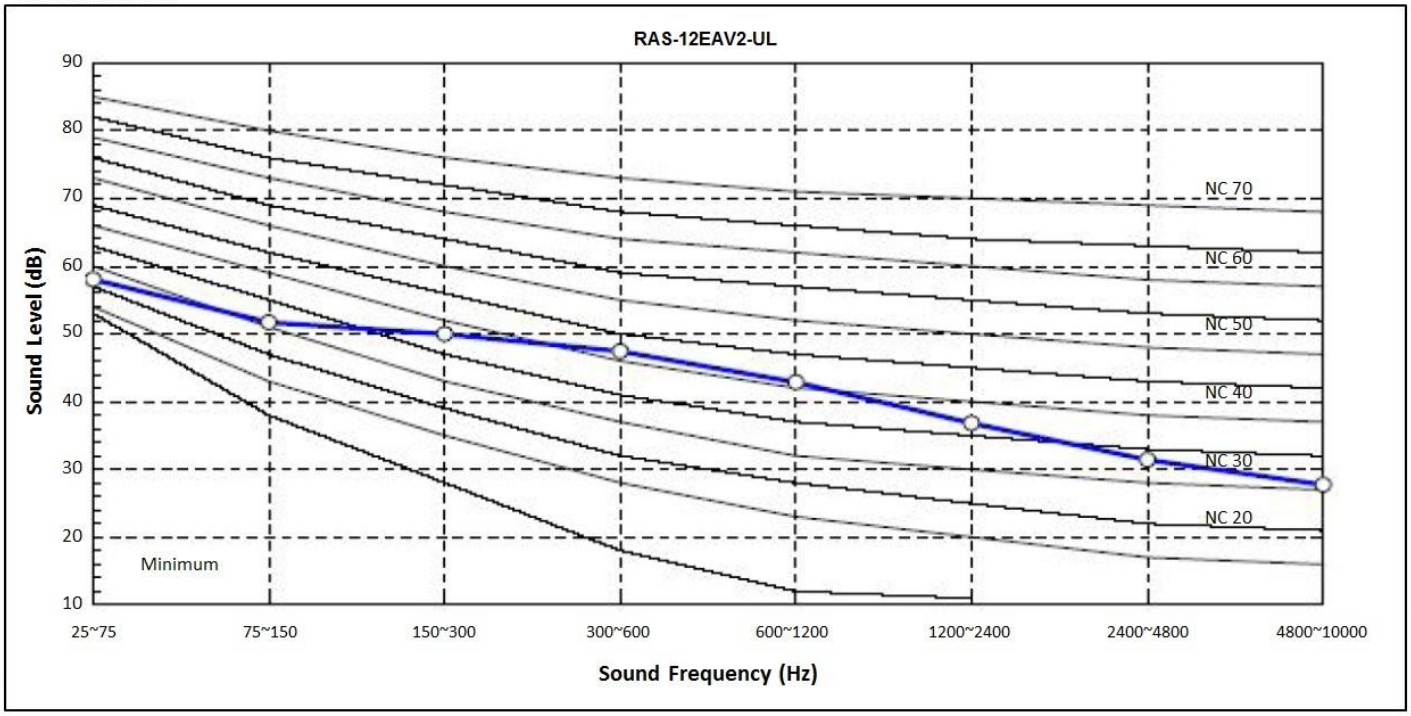
Heating operation



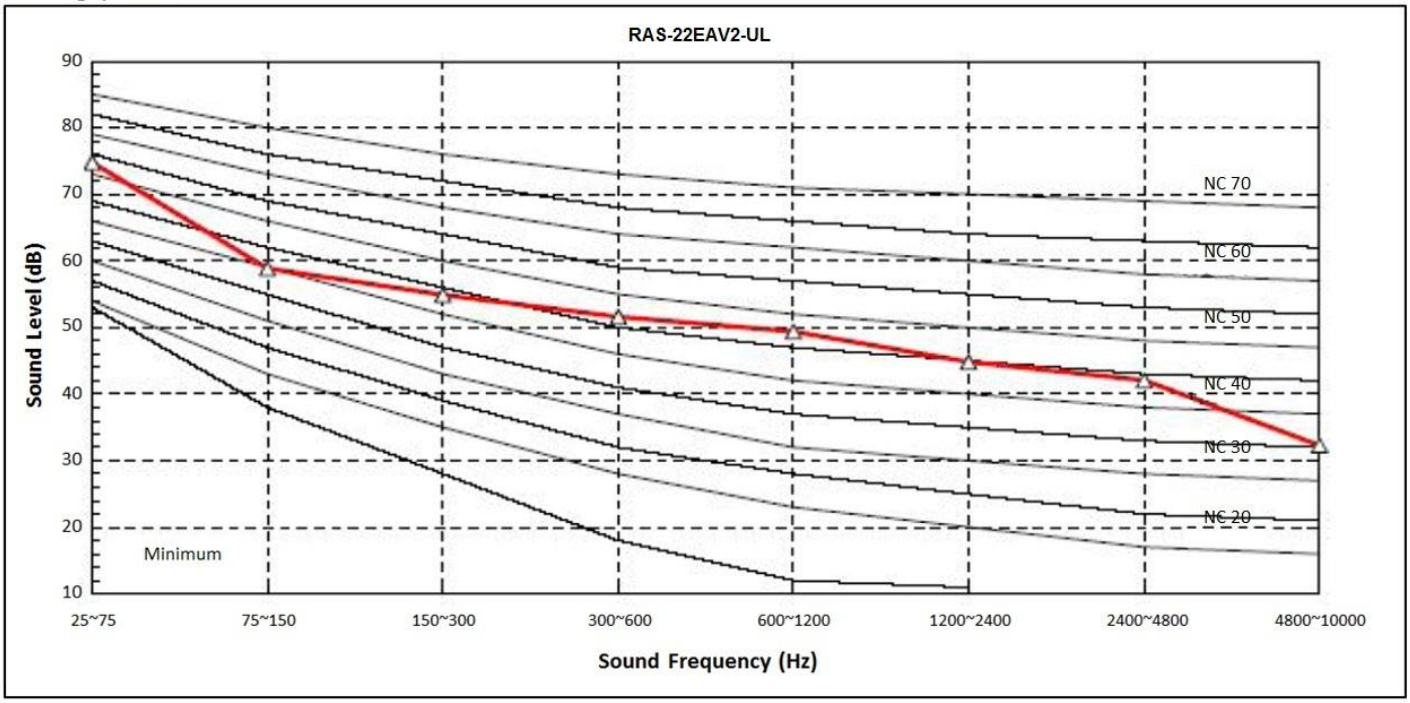
Indoor and outdoor sound characteristic

RAS-22EAV2-UL

Cooling operation



Heating operation



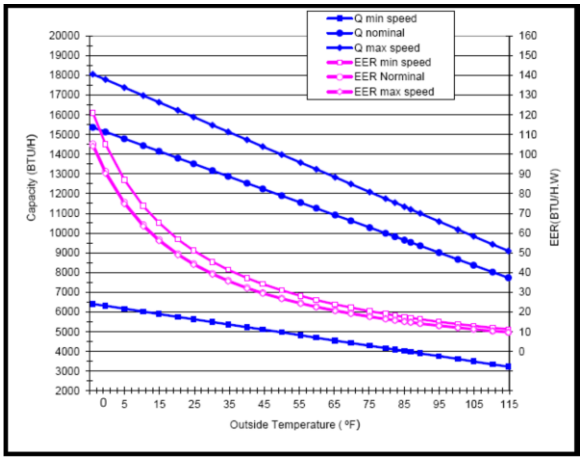
Performance characteristic: RAS-09EKV-UL / RAS-09EAV2-UL

Product specification :

Condition		Capacity (BTU/H)	Power (W)	EER or COP(BTU/H.W)
Cooling In : 80°CDb/67°CWb Out : 95°CDb/75°CWb	Min	3750	250	15.00
	Nominal	9000	690	13.04
	Max	10580	820	12.90
Heating In : 70°CDb/ 60°CWb Out : 47°CDb/43°CWb	Min	3070	170	18.06
	Nominal	10800	800	13.50
	Max	16350	1400	11.68
Heating Low Temperature In : 70°CDb/ 60°CWb Out : 35°CDb/33°CWb	Max	11900	1238	9.61

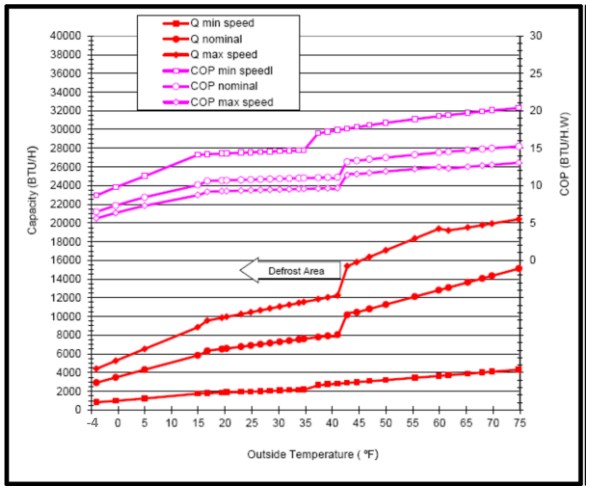
Cooling performance characteristic :

Outside Temp	Minimum capacity			Nominal capacity			Maximum capacity		
	Capacity	Power	EER	Capacity	Power	EER	Capacity	Power	EER
(°F)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)
0	6301	60	104.86	15122	166	91.19	17776	197	90.20
5	6156	71	86.91	14775	196	75.58	17369	232	74.76
10	6012	82	73.69	14429	225	64.08	16962	268	63.39
15	5892	91	65.07	14140	250	56.58	16622	297	55.97
20	5747	101	56.74	13793	280	49.34	16215	332	48.80
25	5627	110	51.04	13505	304	44.38	15875	362	43.90
30	5483	121	45.31	13158	334	39.40	15468	397	38.97
35	5362	130	41.26	12869	359	35.88	15129	426	35.49
40	5218	141	37.08	12523	388	32.25	14721	462	31.90
45	5098	150	34.06	12234	413	29.62	14382	491	29.30
50	4953	160	30.88	11888	443	26.85	13974	526	26.56
55	4809	171	28.09	11541	472	24.43	13567	561	24.17
60	4688	180	26.03	11252	497	22.63	13228	591	22.39
65	4544	191	23.81	10906	527	20.70	12820	626	20.48
70	4424	200	22.14	10617	552	19.25	12481	655	19.04
75	4279	211	20.32	10271	581	17.67	12074	691	17.48
80	4159	220	18.94	9982	606	16.47	11734	720	16.30
82	4087	225	18.17	9809	621	15.80	11530	738	15.63
85	4015	230	17.43	9635	636	15.16	11327	755	15.00
87	3967	234	16.96	9521	646	14.75	11191	767	14.59
90	3894	239	16.28	9347	660	14.15	10987	785	14.00
95	3750	250	15.00	9000	690	13.04	10580	820	12.90
100	3606	261	13.83	8654	720	12.02	10173	855	11.89
105	3485	270	12.92	8365	744	11.24	9833	885	11.12
110	3341	280	11.91	8018	774	10.36	9426	920	10.25
115	3221	289	11.13	7730	799	9.68	9086	949	9.57



Heating performance characteristic :

Outside Temp	Minimum capacity			Nominal capacity			Maximum capacity		
	Capacity	Power	COP	Capacity	Power	COP	Capacity	Power	COP
(°F)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)
-4	828	96	8.67	2913	449	6.48	4409	787	5.61
0	986	101	9.79	3470	474	7.32	5253	830	6.33
5	1224	109	11.26	4306	511	8.42	6519	895	7.28
15	1758	125	14.12	5839	580	10.08	8840	1014	8.72
17	1795	127	14.18	6313	596	10.60	9551	1042	9.16
19	1849	130	14.27	6506	610	10.67	9850	1067	9.23
20	1868	131	14.30	6570	615	10.69	9949	1076	9.25
23	1922	134	14.38	6762	629	10.75	10248	1100	9.31
25	1959	136	14.44	6890	638	10.79	10447	1117	9.35
27	1995	138	14.49	7018	648	10.83	10646	1134	9.39
28	2031	140	14.54	7147	658	10.87	10845	1150	9.43
30	2068	142	14.59	7275	667	10.91	11044	1167	9.47
32	2104	144	14.64	7403	677	10.94	11243	1183	9.50
34	2141	146	14.68	7531	686	10.98	11442	1200	9.54
35	2159	147	14.71	7595	691	10.99	11542	1208	9.55
37	2650	156	16.98	7788	705	11.04	11840	1233	9.60
39	2729	159	17.20	7916	715	11.08	12039	1249	9.64
41	2809	161	17.41	8044	724	11.11	12238	1266	9.67
43	2888	164	17.61	10159	772	13.17	15380	1350	11.39
45	2967	167	17.81	10438	784	13.32	15801	1372	11.52
47	3070	170	18.06	10800	800	13.50	16350	1400	11.68
50	3205	174	18.37	11274	821	13.73	17067	1437	11.88
55	3442	182	18.88	12110	858	14.11	18333	1502	12.21
60	3640	189	19.27	12807	889	14.40	19388	1556	12.46
62	3720	192	19.42	13085	902	14.51	19189	1561	12.29
65	3878	197	19.70	13643	926	14.73	19518	1561	12.50
68	3997	201	19.91	14061	945	14.88	19764	1561	12.66
70	4076	203	20.04	14340	957	14.98	19928	1561	12.76
75	4298	211	20.39	15120	992	15.24	20388	1561	13.06



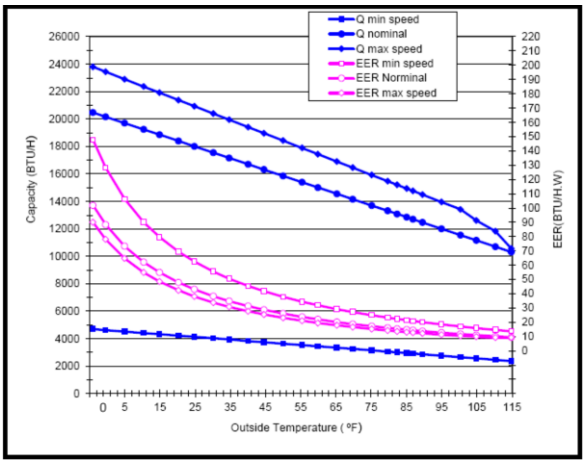
Performance characteristic: RAS-12EKV-UL / RAS-12EAV2-UL

Product specification :

Condition		Capacity (BTU/H)	Power (W)	EER or COP(BTU/H.W)
Cooling In : 80°CDb/67°CWb Out : 95°CDb/75°CWb	Min	2750	150	18.33
	Nominal	12000	950	12.63
	Max	13950	1250	11.16
Heating In : 70°CDb/ 60°CWb Out : 47°CDb/43°CWb	Min	3070	160	19.19
	Nominal	14200	1090	13.03
	Max	19000	1580	12.03
Heating Low Temperature In : 70°CDb/ 60°CWb Out : 35°CDb/33°CWb	Max	14200	1397	10.16

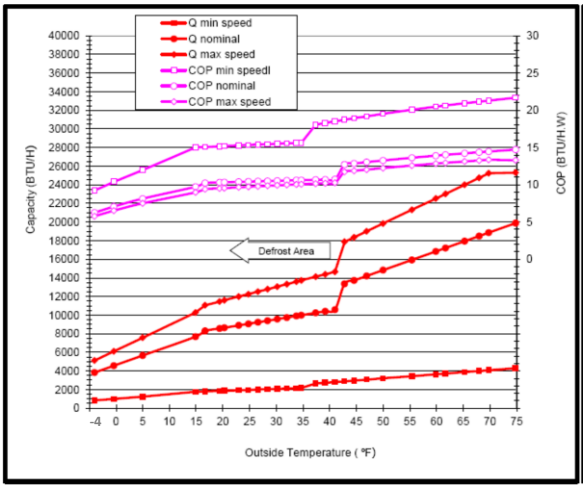
Cooling performance characteristic :

Outside Temp	Minimum capacity			Nominal capacity			Maximum capacity		
	Capacity	Power	EER	Capacity	Power	EER	Capacity	Power	EER
(°F)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)
0	4620	36	128.17	20162	228	88.31	23438	300	78.02
5	4515	43	106.23	19700	269	73.19	22901	354	64.66
10	4409	49	90.07	19238	310	62.05	22364	408	54.83
15	4320	54	79.53	18853	344	54.80	21917	453	48.41
20	4215	61	69.35	18391	385	47.78	21380	506	42.21
25	4126	66	62.38	18006	419	42.98	20932	551	37.97
30	4021	73	55.38	17544	460	38.16	20395	605	33.71
35	3932	78	50.43	17159	494	34.75	19947	650	30.70
40	3826	84	45.32	16697	535	31.23	19410	704	27.59
45	3738	90	41.63	16312	569	28.68	18963	748	25.34
50	3632	96	37.74	15850	610	26.00	18426	802	22.97
55	3526	103	34.34	15388	650	23.66	17889	856	20.90
60	3438	108	31.81	15003	684	21.92	17441	901	19.37
65	3332	115	29.10	14541	725	20.05	16904	954	17.71
70	3244	120	27.06	14156	759	18.64	16456	999	16.47
75	3138	126	24.84	13694	800	17.11	15919	1053	15.12
80	3050	132	23.15	13309	834	15.95	15472	1098	14.09
82	2997	135	22.21	13078	855	15.30	15203	1125	13.52
85	2944	138	21.31	12847	875	14.68	14935	1151	12.97
87	2909	140	20.73	12693	889	14.28	14756	1169	12.62
90	2856	144	19.89	12462	909	13.71	14487	1196	12.11
95	2750	150	18.33	12000	950	12.63	13950	1250	11.16
100	2644	156	16.90	11538	991	11.64	13413	1304	10.29
105	2556	162	15.79	11153	1025	10.88	12608	1285	9.81
110	2450	168	14.56	10691	1066	10.03	11822	1285	9.20
115	2362	174	13.60	10306	1100	9.37	10555	1151	9.17



Heating performance characteristic :

Outside Temp	Minimum capacity			Nominal capacity			Maximum capacity		
	Capacity	Power	COP	Capacity	Power	COP	Capacity	Power	COP
(°F)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)
-4	828	90	9.21	3829	612	6.25	5124	888	5.77
0	986	95	10.40	4562	646	7.06	6105	937	6.52
5	1224	102	11.97	5662	697	8.13	7575	1010	7.50
15	1758	117	15.00	7677	790	9.72	10272	1145	8.98
17	1795	119	15.07	8301	812	10.23	11053	1177	9.40
19	1849	122	15.16	8554	831	10.29	11453	1205	9.51
20	1868	123	15.19	8638	837	10.31	11587	1214	9.55
23	1922	126	15.28	8891	857	10.38	11987	1242	9.65
25	1959	128	15.34	9059	870	10.41	12253	1261	9.72
27	1995	130	15.39	9228	883	10.45	12520	1279	9.79
28	2031	132	15.45	9396	896	10.49	12787	1298	9.85
30	2068	133	15.50	9565	909	10.52	13053	1317	9.91
32	2104	135	15.55	9734	922	10.56	13320	1335	9.98
34	2141	137	15.60	9902	935	10.59	13587	1354	10.03
35	2159	138	15.63	9986	941	10.61	13720	1363	10.06
37	2650	147	18.04	10239	961	10.66	14120	1391	10.15
39	2729	149	18.28	10408	974	10.69	14387	1410	10.20
41	2809	152	18.50	10576	987	10.72	14653	1429	10.26
43	2888	154	18.72	13357	1051	12.71	17872	1524	11.73
45	2967	157	18.92	13724	1068	12.85	18363	1548	11.86
47	3070	160	19.19	14200	1090	13.03	19000	1580	12.03
50	3205	164	19.52	14823	1119	13.25	19834	1622	12.23
55	3442	172	20.06	15922	1169	13.62	21305	1695	12.57
60	3640	178	20.47	16838	1212	13.90	22530	1756	12.83
62	3720	180	20.63	17205	1228	14.01	23021	1781	12.93
65	3878	185	20.93	17938	1262	14.21	24001	1830	13.12
68	3997	189	21.15	18487	1287	14.36	24737	1866	13.25
70	4076	191	21.29	18854	1304	14.45	25227	1891	13.34
75	4298	198	21.66	19880	1352	14.71	25304	1905	13.28



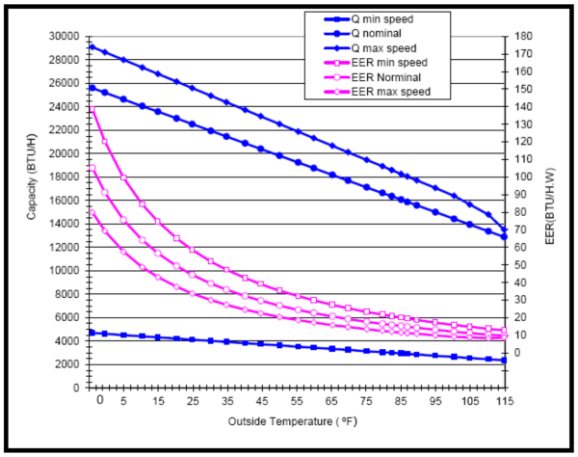
Performance characteristic: RAS-15EKV-UL / RAS-15EAV2-UL

Product specification :

Condition		Capacity (BTU/H)	Power (W)	EER or COP(BTU/H.W)
Cooling	Min	2750	160	17.19
In : 80°CDb/67°CWb	Nominal	15000	1150	13.04
Out : 95°CDb/75°CWb	Max	17050	1720	9.91
Heating	Min	2750	143	19.23
In : 70°CDb/ 60°CWb	Nominal	18000	1400	12.86
Out : 47°CDb/43°CWb	Max	21500	1900	11.32
Heating Low Temperature In : 70°CDb/ 60°CWb Out : 35°CDb/33°CWb	Max	15700	1680	9.35

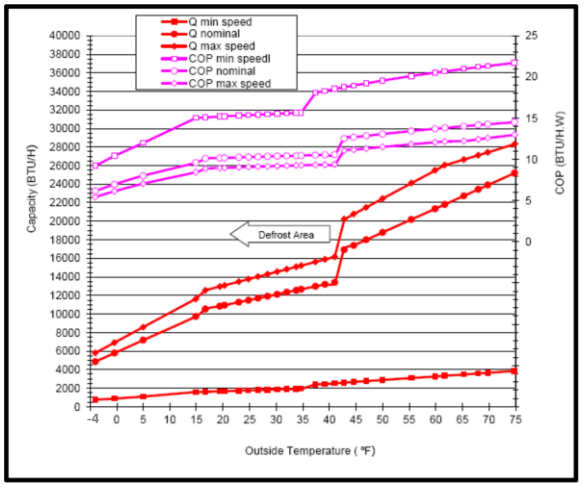
Cooling performance characteristic :

Outside	Minimum capacity			Nominal capacity			Maximum capacity		
Temp	Capacity	Power	EER	Capacity	Power	EER	Capacity	Power	EER
(°F)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)
0	4620	38	120.16	25203	276	91.19	28647	413	69.30
5	4515	45	99.59	24625	326	75.58	27990	487	57.44
10	4409	52	84.44	24048	375	64.08	27334	561	48.70
15	4320	58	74.56	23566	416	56.58	26787	623	43.00
20	4215	65	65.01	22989	466	49.34	26131	697	37.50
25	4126	71	58.48	22508	507	44.38	25584	759	33.73
30	4021	77	51.92	21930	557	39.40	24927	832	29.94
35	3932	83	47.28	21449	598	35.88	24380	894	27.27
40	3826	90	42.49	20871	647	32.25	23724	968	24.51
45	3738	96	39.03	20390	688	29.62	23177	1030	22.51
50	3632	103	35.38	19813	738	26.85	22520	1104	20.40
55	3526	110	32.19	19235	787	24.43	21864	1178	18.57
60	3438	115	29.82	18754	829	22.63	21317	1239	17.20
65	3332	122	27.28	18176	878	20.70	20660	1313	15.73
70	3244	128	25.37	17695	919	19.25	20113	1375	14.63
75	3138	135	23.29	17118	969	17.67	19457	1449	13.43
80	3050	141	21.71	16636	1010	16.47	18910	1510	12.52
82	2997	144	20.82	16348	1035	15.80	18582	1547	12.01
85	2944	147	19.98	16059	1059	15.16	18253	1584	11.52
87	2909	150	19.43	15866	1076	14.75	18035	1609	11.21
90	2856	153	18.65	15578	1101	14.15	17706	1646	10.76
95	2750	160	17.19	15000	1150	13.04	17050	1720	9.91
100	2644	167	15.84	14423	1199	12.02	16394	1794	9.14
105	2556	173	14.81	13941	1241	11.24	15652	1793	8.73
110	2450	179	13.65	13364	1290	10.36	14800	1793	8.25
115	2362	185	12.75	12883	1331	9.68	13495	1561	8.65



Heating performance characteristic :

Outside	Minimum capacity			Nominal capacity			Maximum capacity		
Temp	Capacity	Power	COP	Capacity	Power	COP	Capacity	Power	COP
(°F)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)
-4	742	80	9.23	4854	787	6.17	5798	1067	5.43
0	884	85	10.42	5783	830	6.97	6908	1126	6.13
5	1096	91	11.99	7177	895	8.02	8572	1215	7.06
15	1575	105	15.03	9732	1014	9.60	11624	1376	8.45
17	1608	106	15.10	10522	1042	10.09	12553	1415	8.87
19	1657	109	15.19	10843	1067	10.16	12953	1448	8.94
20	1673	110	15.23	10950	1076	10.18	13087	1460	8.97
23	1722	112	15.32	11270	1101	10.24	13487	1493	9.03
25	1754	114	15.37	11484	1117	10.28	13753	1516	9.07
27	1787	116	15.43	11697	1134	10.32	14020	1538	9.11
28	1820	118	15.48	11911	1151	10.35	14287	1561	9.15
30	1852	119	15.54	12125	1167	10.39	14553	1583	9.19
32	1885	121	15.59	12338	1184	10.42	14820	1606	9.23
34	1918	123	15.64	12552	1201	10.45	15087	1628	9.27
35	1934	123	15.66	12659	1209	10.47	15220	1639	9.28
37	2374	131	18.08	12979	1234	10.52	15620	1673	9.34
39	2445	133	18.32	13193	1251	10.55	15887	1696	9.37
41	2516	136	18.54	13407	1267	10.58	16153	1718	9.40
43	2587	138	18.76	16932	1350	12.54	20224	1832	11.04
45	2658	140	18.97	17396	1372	12.68	20779	1862	11.16
47	2750	143	19.23	18000	1400	12.86	21500	1900	11.32
50	2871	147	19.56	18790	1437	13.08	22443	1950	11.51
55	3084	153	20.10	20183	1502	13.44	24108	2038	11.83
60	3261	159	20.52	21345	1556	13.72	25495	2112	12.07
62	3332	161	20.68	21809	1578	13.82	26050	2141	12.17
65	3474	166	20.98	22738	1621	14.03	26648	2180	12.23
68	3580	169	21.20	23435	1654	14.17	27117	2180	12.44
70	3651	171	21.34	23899	1675	14.27	27430	2180	12.58
75	3850	177	21.71	25200	1736	14.52	28306	2180	12.99



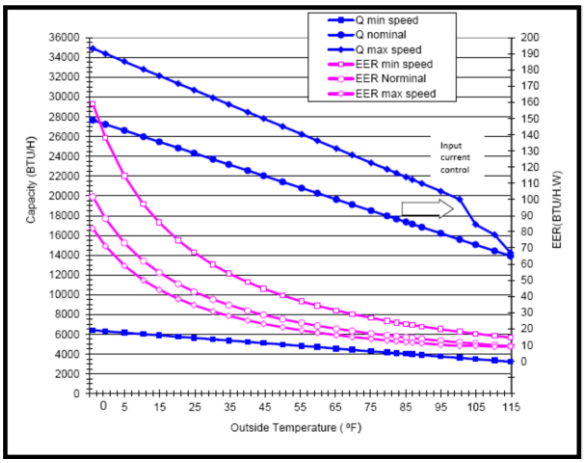
Performance characteristic: RAS-17EKV-UL / RAS-17EAV2-UL

Product specification :

Condition		Capacity (BTU/H)	Power (W)	EER or COP(BTU/H.W)
Cooling	Min	3750	190	19.74
In : 80°CDb/67°CWb	Nominal	16200	1285	12.61
Out : 95°CDb/75°CWb	Max	20450	2010	10.17
Heating	Min	2750	150	18.33
In : 70°CDb/ 60°CWb	Nominal	20200	1630	12.39
Out : 47°CDb/43°CWb	Max	21500	1910	11.26
Heating Low Temperature In : 70°CDb/ 60°CWb Out : 35°CDb/33°CWb	Max	15700	1689	9.30

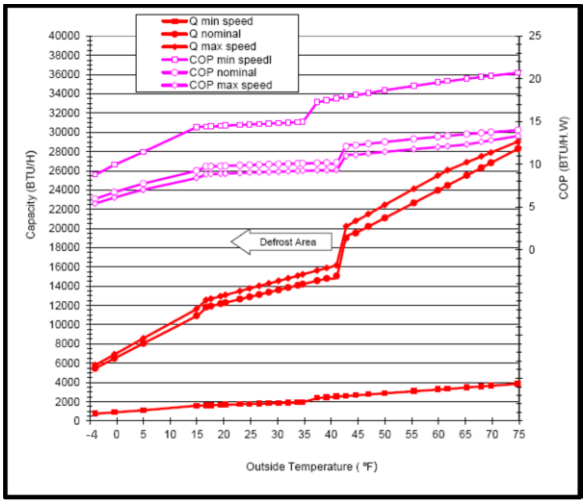
Cooling performance characteristic :

Outside	Minimum capacity			Nominal capacity			Maximum capacity		
Temp	Capacity	Power	EER	Capacity	Power	EER	Capacity	Power	EER
(°F)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)
0	6301	46	137.98	27219	309	88.14	34359	483	71.13
5	6156	54	114.36	26595	364	73.05	33572	570	58.95
10	6012	62	96.96	25971	419	61.93	32785	656	49.98
15	5892	69	85.62	25452	465	54.69	32129	728	44.14
20	5747	77	74.66	24828	521	47.69	31341	814	38.48
25	5627	84	67.15	24308	567	42.90	30685	886	34.62
30	5483	92	59.62	23684	622	38.08	29898	973	30.73
35	5362	99	54.29	23165	668	34.68	29242	1045	27.99
40	5218	107	48.79	22541	723	31.17	28454	1131	25.15
45	5098	114	44.81	22021	769	28.63	27798	1203	23.10
50	4953	122	40.63	21398	825	25.95	27011	1290	20.94
55	4809	130	36.97	20774	880	23.61	26224	1376	19.06
60	4688	137	34.25	20254	926	21.88	25568	1448	17.65
65	4544	145	31.32	19630	981	20.01	24780	1535	16.15
70	4424	152	29.13	19111	1027	18.61	24124	1607	15.02
75	4279	160	26.74	18487	1082	17.08	23337	1693	13.78
80	4159	167	24.93	17967	1128	15.92	22681	1765	12.85
82	4087	171	23.91	17655	1156	15.27	22287	1808	12.32
85	4015	175	22.94	17343	1184	14.65	21893	1852	11.82
87	3967	178	22.32	17136	1202	14.25	21631	1880	11.50
90	3894	182	21.42	16824	1230	13.68	21237	1924	11.04
95	3750	190	19.74	16200	1285	12.61	20450	2010	10.17
100	3606	198	18.19	15576	1340	11.62	19633	2091	9.39
105	3485	205	17.00	15057	1386	10.86	17110	1793	9.54
110	3341	213	15.67	14433	1442	10.01	16068	1793	8.96
115	3221	220	14.64	13913	1488	9.35	14233	1561	9.12



Heating performance characteristic :

Outside	Minimum capacity			Nominal capacity			Maximum capacity		
Temp	Capacity	Power	COP	Capacity	Power	COP	Capacity	Power	COP
(°F)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)
-4	742	84	8.80	5447	916	5.95	5798	1073	5.40
0	884	89	9.94	6490	966	6.72	6908	1132	6.10
5	1096	96	11.44	8054	1042	7.73	8572	1221	7.02
15	1575	110	14.33	10921	1181	9.25	11624	1384	8.40
17	1608	112	14.39	11808	1214	9.73	12553	1422	8.83
18	1624	113	14.43	11928	1223	9.75	12687	1434	8.85
19	1657	114	14.49	12168	1243	9.79	12953	1456	8.90
20	1673	115	14.52	12288	1252	9.81	13087	1467	8.92
23	1722	118	14.60	12648	1281	9.87	13487	1501	8.98
25	1754	120	14.66	12887	1301	9.91	13753	1524	9.03
27	1787	121	14.71	13127	1320	9.94	14020	1546	9.07
28	1820	123	14.76	13367	1340	9.98	14287	1569	9.11
30	1852	125	14.81	13607	1359	10.01	14553	1592	9.14
32	1885	127	14.86	13846	1378	10.04	14820	1614	9.18
34	1918	129	14.91	14086	1398	10.08	15087	1637	9.22
35	1934	130	14.93	14206	1408	10.09	15220	1648	9.23
37	2374	138	17.24	14566	1437	10.14	15620	1682	9.29
39	2445	140	17.46	14806	1456	10.17	15887	1705	9.32
41	2516	142	17.68	15045	1475	10.20	16153	1727	9.35
43	2587	145	17.88	19001	1572	12.09	20224	1842	10.98
45	2658	147	18.08	19522	1597	12.22	20779	1872	11.10
47	2750	150	18.33	20200	1630	12.39	21500	1910	11.26
50	2871	154	18.65	21086	1673	12.60	22443	1960	11.45
55	3084	161	19.16	22650	1749	12.95	24108	2049	11.77
60	3261	167	19.56	23953	1812	13.22	25495	2123	12.01
62	3332	169	19.71	24475	1837	13.32	26050	2153	12.10
65	3474	174	20.00	25517	1887	13.52	26874	2180	12.33
68	3580	177	20.21	26299	1925	13.66	27480	2180	12.61
70	3651	179	20.34	26820	1951	13.75	27884	2180	12.79
75	3850	186	20.70	28280	2021	13.99	29016	2180	13.31



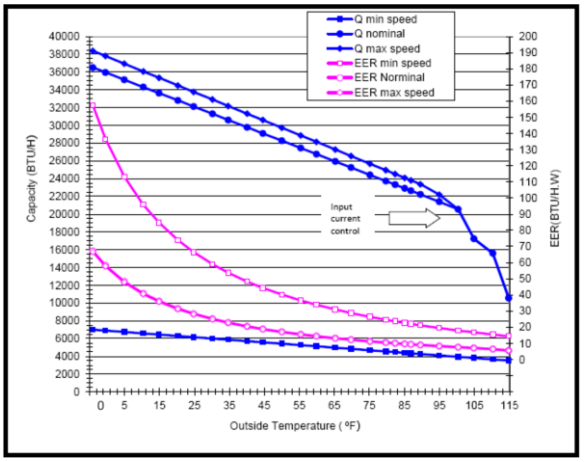
Performance characteristic: RAS-22EKV-UL / RAS-22EAV2-UL

Product specification :

Condition		Capacity (BTU/H)	Power (W)	EER or COP(BTU/H.W)
Cooling In : 80°CDb/67°CWb Out : 95°CDb/75°CWb	Min	4100	210	19.52
	Nominal	21400	2570	8.33
	Max	22500	2720	8.27
Heating In : 70°CDb/ 60°CWb Out : 47°CDb/43°CWb	Min	3450	190	18.16
	Nominal	23200	2200	10.55
	Max	24350	2440	9.98
Heating Low Temperature In : 70°CDb/ 60°CWb Out : 35°CDb/33°CWb	Max	18400	2157	8.53

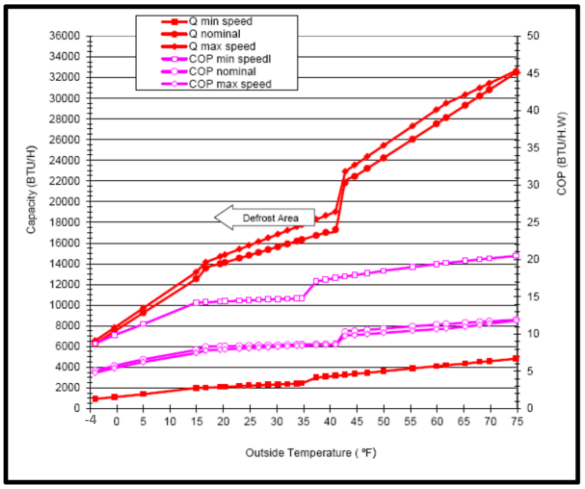
Cooling performance characteristic :

Outside Temp	Minimum capacity			Nominal capacity			Maximum capacity		
	Capacity	Power	EER	Capacity	Power	EER	Capacity	Power	EER
(°F)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)
0	6889	50	136.49	35956	618	58.21	37804	654	57.83
5	6731	60	113.12	35132	728	48.25	36938	771	47.93
10	6573	69	95.91	34308	839	40.91	36071	888	40.64
15	6441	76	84.69	33621	931	36.12	35349	985	35.88
20	6284	85	73.85	32797	1041	31.50	34483	1102	31.29
25	6152	93	66.43	32111	1133	28.33	33761	1200	28.15
30	5994	102	58.97	31287	1244	25.15	32895	1316	24.99
35	5863	109	53.70	30600	1336	22.90	32173	1414	22.75
40	5705	118	48.27	29776	1446	20.59	31307	1531	20.45
45	5573	126	44.33	29090	1539	18.91	30585	1628	18.78
50	5415	135	40.19	28266	1649	17.14	29719	1745	17.03
55	5258	144	36.57	27442	1760	15.60	28853	1862	15.49
60	5126	151	33.88	26755	1852	14.45	28131	1960	14.35
65	4968	160	30.99	25931	1962	13.22	27264	2077	13.13
70	4837	168	28.81	25245	2054	12.29	26543	2174	12.21
75	4679	177	26.45	24421	2165	11.28	25676	2291	11.21
80	4547	184	24.66	23734	2257	10.52	24954	2389	10.45
82	4468	189	23.65	23322	2312	10.09	24521	2447	10.02
85	4389	193	22.69	22910	2367	9.68	24088	2506	9.61
87	4337	196	22.08	22636	2404	9.41	23799	2545	9.35
90	4258	201	21.19	22224	2459	9.04	23366	2603	8.98
95	4100	210	19.52	21400	2570	8.33	22186	2677	8.29
100	3942	219	18.00	20552	2677	7.68	20552	2677	7.68
105	3811	227	16.82	17227	2409	7.15	17227	2409	7.15
110	3653	236	15.51	15592	2409	6.47	15592	2409	6.47
115	3521	243	14.48	10549	1908	5.53	10549	1908	5.53

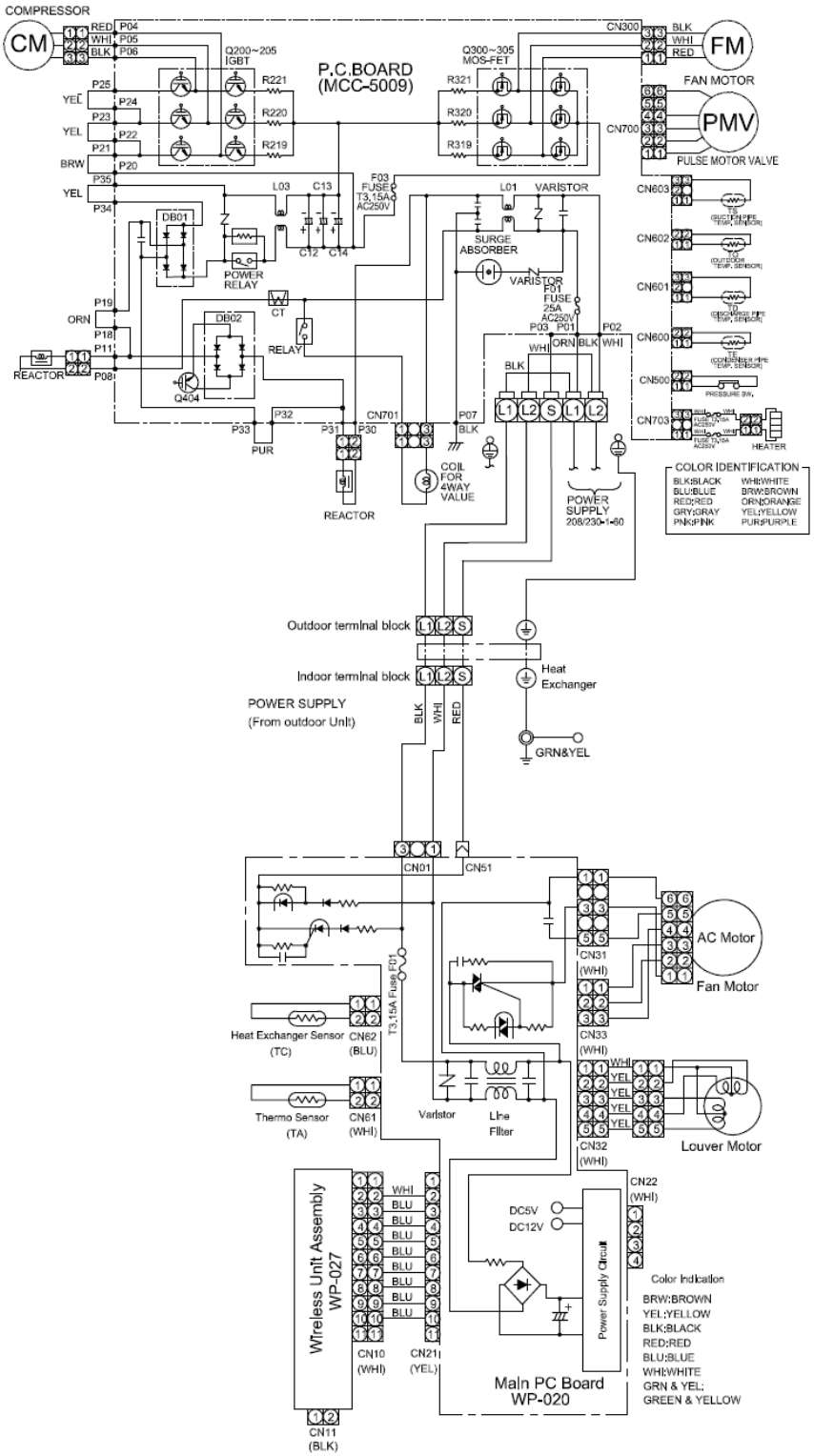


Heating performance characteristic :

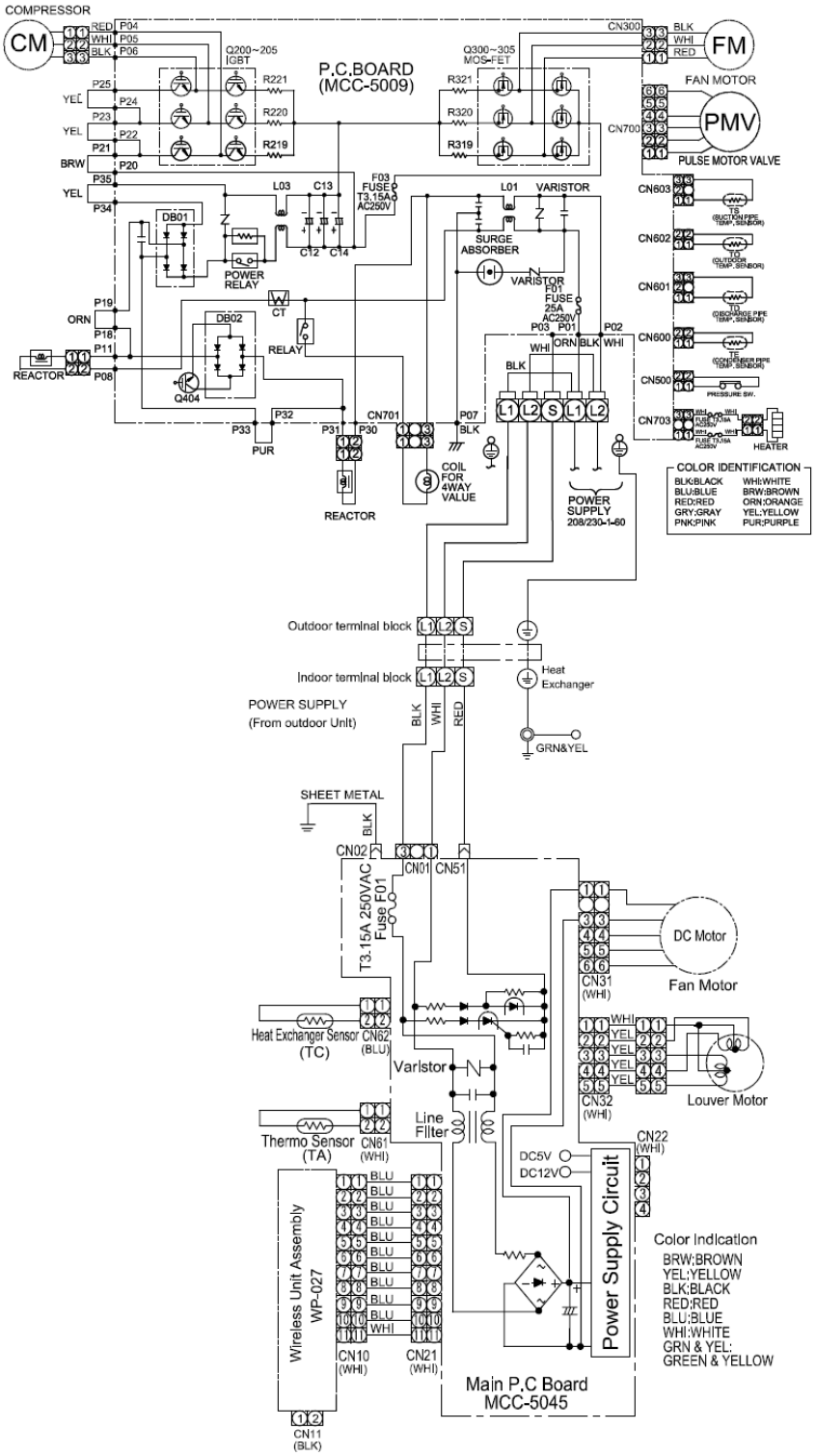
Outside Temp	Minimum capacity			Nominal capacity			Maximum capacity		
	Capacity	Power	COP	Capacity	Power	COP	Capacity	Power	COP
(°F)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)	(BTU/H)	(W)	(BTU/H.W)
-4	930	107	8.72	6257	1236	5.06	6567	1371	4.79
0	1108	113	9.84	7454	1304	5.72	7823	1446	5.41
5	1376	121	11.33	9250	1406	6.58	9709	1560	6.22
15	1976	139	14.19	12543	1594	7.87	13165	1768	7.45
17	2017	141	14.26	13562	1638	8.28	14141	1817	7.78
19	2078	145	14.35	13975	1677	8.33	14682	1860	7.89
20	2099	146	14.38	14113	1690	8.35	14863	1875	7.93
23	2160	149	14.46	14526	1730	8.40	15404	1918	8.03
25	2201	152	14.52	14801	1756	8.43	15765	1947	8.10
27	2242	154	14.57	15077	1782	8.46	16126	1976	8.16
28	2283	156	14.62	15352	1808	8.49	16487	2004	8.23
30	2324	158	14.67	15627	1834	8.52	16848	2033	8.29
32	2365	161	14.72	15903	1861	8.55	17209	2062	8.35
34	2406	163	14.76	16178	1887	8.57	17570	2091	8.40
35	2426	164	14.79	16316	1900	8.59	17750	2105	8.43
37	2978	174	17.08	16729	1939	8.63	18292	2149	8.51
39	3067	177	17.29	17004	1965	8.65	18653	2178	8.57
41	3156	180	17.51	17280	1991	8.68	19014	2206	8.62
43	3245	183	17.71	21823	2122	10.29	22905	2353	9.73
45	3334	186	17.91	22422	2156	10.40	23533	2391	9.84
47	3450	190	18.16	23200	2200	10.55	24350	2440	9.98
50	3601	195	18.47	24218	2258	10.73	25418	2504	10.15
55	3868	204	18.98	26014	2360	11.02	27303	2618	10.43
60	4091	211	19.37	27511	2445	11.25	28874	2712	10.65
62	4180	214	19.52	28109	2479	11.34	29503	2750	10.73
65	4358	220	19.81	29307	2547	11.50	30335	2762	10.98
68	4492	224	20.01	30205	2599	11.62	30988	2762	11.22
70	4581	227	20.15	30804	2633	11.70	31423	2762	11.38
75	4830	236	20.50	32480	2728	11.91	32643	2762	11.82



Wiring diagrams: RAS-09EKV-UL / RAS-09EAV2-UL



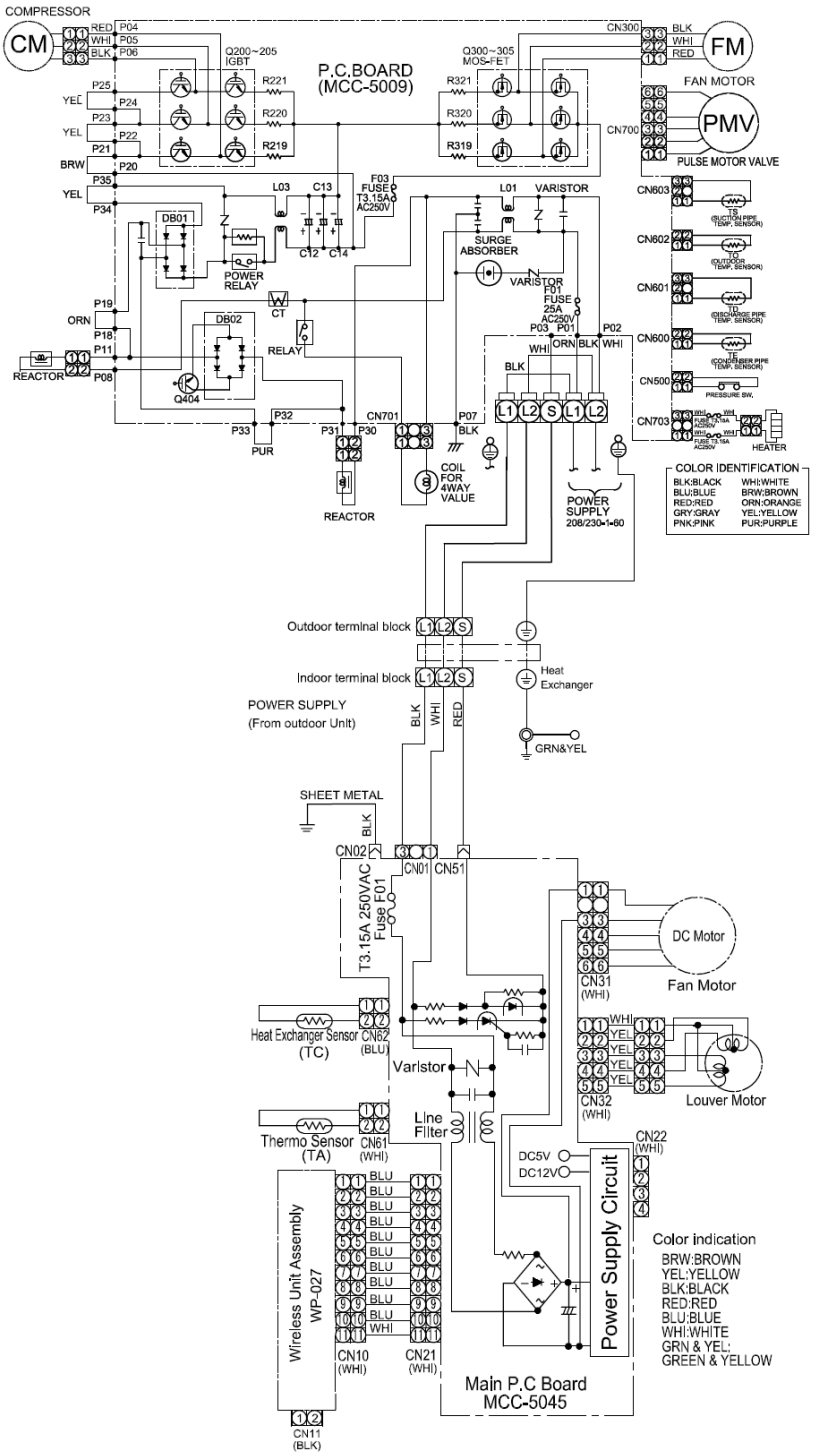
Wiring diagrams: RAS-12EKV-UL / RAS-12EAV2-UL



Wiring diagrams: RAS-15EKV-UL / RAS-15EAV2-UL

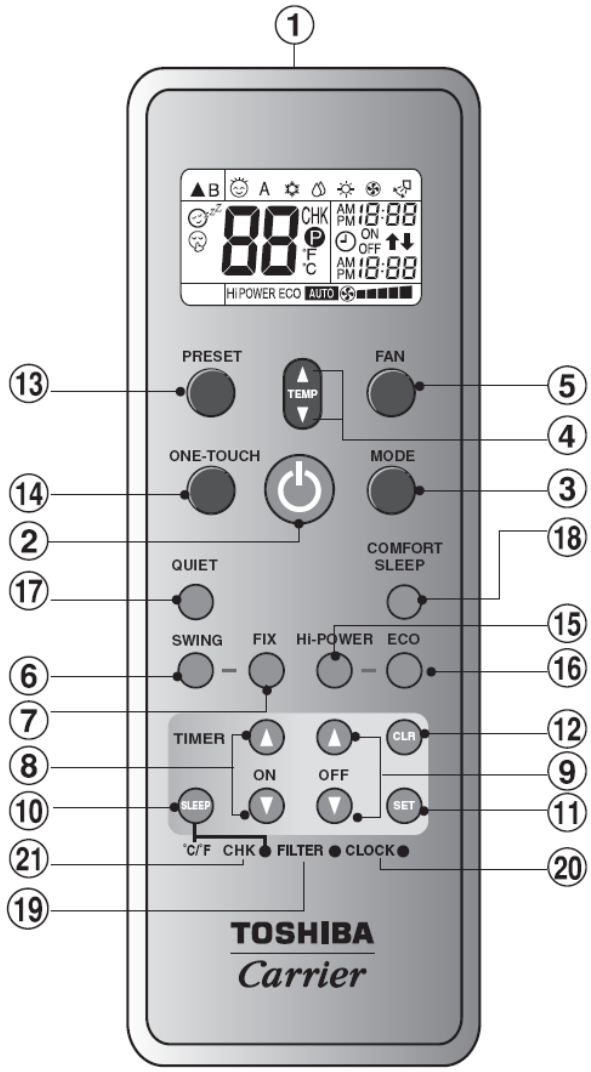
RAS-17EKV-UL / RAS-17EAV2-UL

RAS-22EKV-UL / RAS-22EAV2-UL



Standard wireless remote controller

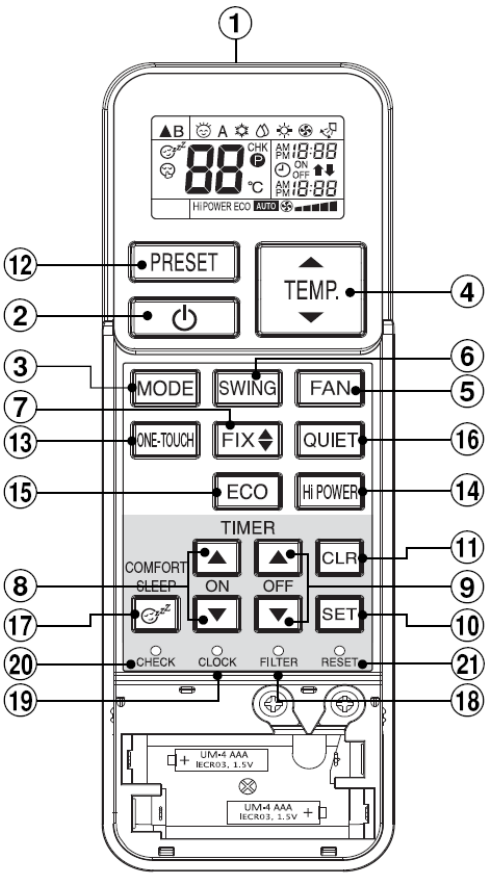
① Infrared signal emitter
② Start/Stop button
③ Mode select button (MODE)
④ Temperature button (TEMP)
⑤ Fan speed button (FAN)
⑥ Swing louver button (SWING)
⑦ Set louver button (FIX)
⑧ On timer button (ON)
⑨ Off timer button (OFF)
⑩ Sleep timer button (SLEEP)
⑪ Setup button (SET)
⑫ Clear button (CLR)
⑬ Memory and Preset button (PRESET)
⑭ One-Touch button (ONE-TOUCH)
⑮ High power button (Hi-POWER)
⑯ Economy button (ECO)
⑰ Quiet button (QUIET)
⑱ Comfort sleep button (COMFORT SLEEP)
⑲ Filter reset button (FILTER)
⑳ Clock Reset button (CLOCK)
㉑ Check button (CHK)



Optional wired connectable remote controller

Model name: ASM-OPTIONAL-RC (WH-TA14NE) 1111855001 → °F Display
ASM-OPTIONAL-RC (WH-TA15NE) 1111855002 → °C Display

① Infrared signal emitter
② Start/Stop button
③ Mode select button (MODE)
④ Temperature button (TEMP)
⑤ Fan speed button (FAN)
⑥ Swing louver button (SWING)
⑦ Set louver button (FIX)
⑧ On timer button (ON)
⑨ Off timer button (OFF)
⑩ Setup button (SET)
⑪ Clear button (CLR)
⑫ Memory and Preset button (PRESET)
⑬ One-Touch button (ONE-TOUCH)
⑭ High power button (Hi-POWER)
⑮ Economy button (ECO)
⑯ Quiet button (QUIET)
⑰ Comfort sleep button (COMFORT SLEEP)
⑱ Filter reset button (FILTER)
⑲ Set clock button (CLOCK)
⑳ Check button (CHECK)
㉑ Reset button (RESET)



TOSHIBA

Carrier